Pricing sin stocks: Ethical preference vs. risk aversion

Pricing Sin Stocks: Ethical Preference vs. Risk Aversion*

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Abstract

We develop an ethical preference-based model that reproduces the average return and volatility spread between sin and non-sin stocks. Our investors do not necessarily boycott sin companies. Rather, they are open to invest in any company while trading off dividends against ethicalness. When dividends and ethicalness are complementary goods and investors are sufficiently risk averse, the model predicts that the dividend share of sin companies exhibits a positive relation with the future return and volatility spreads. An empirical analysis supports the model's predictions. Taken together, our results point to the importance of ethical preferences for investors' portfolio choices and asset prices.

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1 Introduction

The interest in socially responsible investments has been steadily growing in recent years.[1] Individual and institutional investors increasingly seek profit opportunities consistent with their personal values and capable of boosting social well-being. And it is well documented that investments in stocks that promote social goals and ethical behavior underperform relative to those in activities that are generally considered sinful (such as alcohol, tobacco, and gambling industries).

Several studies, indeed, find that sin stocks yield (on average) higher returns than those of non-sin comparable stocks (among others, Hong and Kacperczyk, 2009). This so-called "sin premium" is often rationalized by a "boycott" risk factor, namely, the risk that socially responsible investors refuse to hold stocks of sin companies (Luo and Balvers, 2017). The term "socially responsible investors" refers to agents who support investments in companies actively engaged in ethical themes, such as environmental sustainability, social justice, gender equality, while avoiding companies whose business is related to addictive substances like tobacco, alcohol and gambling. Therefore, sin companies are underpriced relative to non-sin companies and must promise higher returns to attract a large enough investor base.

However, the behavior of individual and institutional investors towards sin stocks may significantly differ. Institutional investors, such as mutual funds, pension funds, and foundations, may be subject to social pressures rising from their public exposure, and, accordingly, tend to be reluctant to hold stocks that are in conflict with their customers' ethical principles. Individual investors, on the contrary, are generally free from transparency and accountability concerns and, consequently, may be more open to invest in any kind of stocks (Heinkel, Kraus, and Zechner, 2008; Hong and Kacperczyk, 2009; Hong

[1] According to the US SIF Foundation's 2016 Report, from 1995 to 2016 the "SRI universe has increased nearly 14-fold, a compound annual growth rate of 13.25 percent."

and Kostovetsky, 2012; Luo and Balvers, 2017).

In light of these considerations, in this paper we relax the boycott assumption and suggest a more general approach to study the sin-stock anomaly. We assume that investors have preferences for gain opportunities (dividends) but weigh them according to their perception of firms' responsible behavior (ethicalness). Investors do not necessarily boycott any particular class of companies and are willing to receive dividends from both sin and non-sin stocks. Here the role of substitutability between dividends and ethicalness is crucial for price formation, uncovering a new economic channel capable of explaining the return and volatility spreads between these categories of stocks.

In equilibrium, the return spread between sin and non-sin stocks depends on the marginal rate of substitution between dividends and ethicalness, which, in turn, depends on the interaction between dividend-ethicalness complementarity and risk aversion. We show that sin stocks have higher average returns and volatility than non-sin stocks in two cases: (i) when dividends and ethicalness are substitute goods and investors have low risk aversion (i.e., smaller than log utility), and (ii) when dividends and ethicalness are complementary goods and investors have high risk aversion (i.e., higher than log utility).

In both cases, the desired marginal rate of substitution between dividend payments and ethicalness is positive, which implies that investors would like to receive more dividends from non-sin stocks than from sin stocks. However, since dividend payments are beyond investors' control, the expected returns must adjust to offset the "ethical" cost of holding less desirable stocks (sin stocks). In line with the U.S. empirical evidence, our model produces the average positive return and volatility spreads between sin and non-sin stocks.

The above cases suggest that two mutually exclusive preference specifications can explain the average return and volatility spreads between sin and non-sin stocks. However, these two settings generate opposite patterns of moments differentials, conditional on the sin dividend share. The return and volatility spreads exhibit a negative relation with the dividend share in case (i), and positive in case (ii).

To understand which of the two preference specifications is consistent with the data, we investigate the empirical relation between conditional moments and dividend payments. Using U.S. data, we provide evidence supporting case (ii), that is, risk averse investors treat monetary gains and ethical behaviors as complementary goods.

We then conduct micro-level tests on the mechanism behind our model. Using data on the portfolio choices of retail investors, we show that investors prefer to receive dividends from ethical companies and, as a consequence, re-balance their portfolio away from sin companies after those companies pay dividends.

Moreover, the sin premium in our model arguably more closely depends on the behavior of retail investors than of institutional investors, being the former investors' allocation choices subject to less public scrutiny. Thus, one would expect that the predictability results illustrated above are stronger for companies with low institutional ownership. Our empirical analysis confirms that this is indeed the case.

Our approach allows us to overcome several limitations of the boycott risk literature. First, assuming that a non-negligible group of investors refuses to hold sin stocks implies that diversification opportunities do not play an important role in price formation. Under the boycott assumption, socially responsible investors are, indeed, never attracted by arbitrarily high (expected) returns of stocks that are considered ethically inappropriate and, thus, they only receive dividend payments from the shares of ethical companies they own. By contrast, in our model investors diversify between non-sin and sin companies, and their desire of diversification, which ultimately explains the moments differentials between the two types of stocks, depends on their preferences for firm's ethicalness. Moreover, testing versions of the CAPM with restricted investors (i.e., investors who boycott a given class of stocks) is problematic because equilibrium returns depend on the fraction of constrained agents and on their wealth share, which are non-observable quantities (Levy, 1978; Malkiel and Xu, 2006). Instead, our predictions, being based on more easily observable quantities, are better amenable to empirical testing.

Second, the boycott-based models are explicitly designed to focus on the unconditional return spread between sin and non-sin stocks, thus neglecting the *conditional* return spread, as well as the unconditional and conditional volatility spreads. More generally, few studies in the literature on sin stocks look at conditional moments. Salaber (2009) tests a conditional model that allows for time-varying risk premia and shows that several macroeconomic variables (such as the default spread, the term spread, and the dividend yield) help to explain the return differential between sin and non-sin stocks. In a similar fashion, Liston (2016) shows that the conditional excess returns and the conditional standard deviation of sin stocks are affected by investor sentiment. We provide a joint characterization of the behavior of the unconditional and conditional moments differentials, and progress the understanding of the conditional properties of the stock returns of sin and non-sin stocks.

The rest of the paper is organized as follows. In Section 2, we present the model and establish our main theoretical results. In Section 3, we calibrate the model to obtain testable predictions. In Section 4, we present the data and test the empirical predictions of the model. Section 5 concludes.

2 The economy

Our model is built on a continuous-time Lucas (1978) economy with an infinite horizon. There are two firms: a "sin" firm and a "non-sin" firm indexed by "s" and "n", respectively. The uncertainty is represented by a filtered probability space $(\Omega, \mathcal{F}, \{\mathcal{F}_t\}, \mathbb{P})$ on which we define a two-dimensional Brownian motion $B_t = (B_{s,t}, B_{n,t})$ that captures production randomness over time.

2.1 Consumption goods

There are two perishable consumption goods, $i \in \{s, n\}$. A convex combination of the two consumption goods (with weights α and $1-\alpha$, respectively) serves as the numeraire. The price of the numeraire is normalized to unity and the relative prices of the two consumption goods are denoted by $p_t = (p_{s,t}, p_{n,t})$. Consumption goods are produced by two firms according to the following production technology

$$dD_{i,t} = D_{i,t}\left(\nu_i dt + \phi_i dB_{i,t}\right), \qquad i \in \{s, n\}, \tag{1}$$

where $D_{i,t}$ represents the total supply of good i, and $D_{i,0}$, ν_i and ϕ_i are positive coefficients.[2] The two firms are characterized by a different degree of perceived ethicalness, which is constant over time and is represented by the parameter π_i, with $i \in \{s, n\}$.[3] We assume that the degree of ethicalness of sin companies is lower than that of non-sin companies, i.e., $\pi_s < \pi_n$.

As will become clear later, two quantities are key in our model: the (time-varying) dividend share of sin companies, $d_{s,t} := \frac{D_{s,t}}{D_{s,t}+D_{n,t}}$, and their (constant) relative degree of ethicalness $\xi_s := \frac{\pi_s}{\pi_s+\pi_n}$. It is worth noting that as long as $\xi_s < 0.5$ (i.e., $\pi_s < \pi_n$) the magnitudes of π_s and π_n are not particularly relevant for our main message. In other words, one may also think of non-sin stocks simply as companies with a higher degree of ethicalness than sin companies or, more generally, as a portfolio comprising any stocks in the market other than sin stocks. This interpretation does not affect the analytical

[2] In the Lucas' pure-exchange economy, $D_{i,t}$ represents both the supply of consumption good i and the dividend paid by firm i. Therefore, when describing the implications of our theoretical framework, we use the terms consumption and dividend interchangeably. In the calibration exercise and empirical tests, we rely on the time-series of dividends paid by sin and non-sin companies.

[3] Note that in our framework the investors' judgment of company ethicalness depends on the consumption good produced by the company and, as a result, does not change over time. For example, a company producing whiskey will always be labeled as sin in our framework, while a company producing orange juice will always be labeled as non-sin, consistent with the original idea of Hong and Kacperczyk (2009) and with the empirical analysis of Section 4.

results presented below. However, following the original scheme in Hong and Kacperczyk (2009), we interpret non-sin companies as those involved in the food, soda, fun, and meals industries, i.e., industries that are *comparable* to our sin industries in terms of durability. This interpretation makes our theoretical model consistent with our empirical analysis.

2.2 Ethicalness

Our main departure from the traditional asset pricing literature is the assumption that investors' utility not only depends on asset payoffs but also on firms' ethicalness. This possibility has already been suggested by the existing literature.[4]

Excluding the general theoretical considerations of Beal et al. (2005), little to no guidance exists on how to incorporate company ethicalness into the investors' utility function, especially in a fully dynamic asset pricing model. Recently, Riedl and Smeets (2017) find strong empirical evidence in favor of pro-social preferences. They show that social investors are willing to accept lower returns from ethical investments in exchange for the possibility to invest in stocks that are in concordance with their social preferences.

However, a full understanding of the nature of pro-social behavior and how it endogenously contributes to the prices and returns of traded assets is still missing. With this in mind, we introduce a preference specification capable of disclosing one key feature, namely, the complementarity/substitutability between firms' monetary payoff and ethicalness.[5]

[4]Beal, Goyen, and Philips (2005), at p. 72, argue that "including the perceived level of ethicality of an investment in the investor's utility function" is one possible way to incorporate ethicalness into a theoretical framework. Fama and French (2007) argue that socially responsible investors might also get utility from firm characteristics (such as social behavior) above and beyond the payoff provided by the asset. Bollen (2007) suggests that investors may have a multi-attribute utility function: a standard attribute capturing the asset payoff and non-standard attributes depending on the firm's social behavior.

[5]The latter can also be interpreted as a public good (e.g., environmental quality as in Kotchen, 2006).

2.3 Preferences

Investors derive utility from both the consumption goods $c_{i,t}$ (i.e., the dividends) and the perceived degree of ethicalness π_i of sin and non-sin firms, with $i \in \{s, n\}$:

$$U(c_{s,t}, c_{n,t}) = \pi_s^{\theta} \frac{(c_{s,t})^{1-\gamma}}{1-\gamma} + \pi_n^{\theta} \frac{(c_{n,t})^{1-\gamma}}{1-\gamma}. \tag{2}$$

Here, $\gamma > 0$ represents the relative risk aversion of investors, while we interpret the parameter θ as a measure of investors' ethicalness sensitivity.[6] Precisely, θ governs the complementarity between ethicalness and dividends. If $\theta > 0$ (< 0), ethicalness and dividends are complementary (substitute) goods, that is an increase in the ethicalness of firm i increases (decreases) the marginal utility of consuming the dividend of firm i.[7]

Since firm's ethicalness affects the marginal utility of consumption, it directly influences the investors' desire of diversification between non-sin and sin dividends which, in turn depends on risk aversion.[8] As a result, the impact of firm's ethicalness on the investors' utility does not depend on the complementary between ethicalness and dividends only (captured by θ), but also on the investors' desire of diversification (captured by γ), and the interaction between theses two forces. This interaction is the key economic channel introduced in this paper.

Our framework is motivated by the distinction between individual and institutional investors. Institutional investors typically operate under guidelines that sometimes may

[6] Note that the degree of ethicalness of firm i (π_i) perceived by the investors is exogenously controlled by the firm and, thus, it is not a choice variable for our representative agent who, instead, maximizes utility with respect to consumption only. Therefore, we only need to guarantee that the utility function in (2) is concave in c_i, which implies that we must have $\gamma > 0$. Differently, the utility (2) is well-defined for all values of θ.

[7] The link between θ and the dividend-ethicalness complementarity is given by their cross-derivative $\frac{\partial^2 U}{\partial \pi_i \partial c_{i,t}} = \theta \pi_i^{\theta-1} c_{i,t}^{-\gamma}$, with $i \in \{s, n\}$, and the sign of these derivatives depends on θ only.

[8] The incentives to diversify consumption of the two dividends in reaction to changes in the marginal utility are governed by risk aversion: the bigger the risk aversion is, the more rapidly the marginal utility decreases when consumption increases, the stronger it is the motivation for adjusting consumption according to the marginal utility.

lead to the exclusion of unethical companies from their portfolios. Consistently, Hong and Kacperczyk (2009) find that institutional investors underweight sin stocks, and thus shareholdings of sin stocks tend to be concentrated among individual investors. Thus, the question arises: to what extent are investors willing to sacrifice financial payoffs in exchange for ethicalness?[9] Our setting allows us to address this question.

2.4 Financial market

There are three securities traded on the market: two risky assets (stocks) in positive supply of one unit and one risk-free asset (bond) in zero-net supply. Stock i represents the claim to dividend i paid in units of good i, where $i \in \{s, c\}$. The stock price, denoted by $S_{i,t}$, evolves as follows

$$dS_{i,t} + p_{i,t}D_{i,t}dt = S_{i,t}\mu_{i,t}dt + S_{i,t} \sum_{j\in\{s,n\}} \sigma^i_{j,t} dB_{j,t}. \tag{3}$$

The price of the risk-free asset (in term of the numeraire) satisfies

$$S_{0,t} = e^{\int_0^t r_s ds} \tag{4}$$

for some risk-free rate of return r_t. The variables $\mu_{i,t}$, $\sigma^i_{j,t}$, r_t, $p_{i,t}$, for $i, j \in \{s, n\}$, are to be endogenously determined in equilibrium.

[9] This question is debated in the existing literature. Fabozzi, Ma, and Oliphant (2008) argue that, although investors normally claim that they do not invest in companies viewed as unethical, “the validity of the responses could be questioned because of the desire of those polled to respond in a politically correct fashion, and not necessarily putting their money where their mouths are (p. 83).” Lemieux (2003) reaches similar conclusions.

2.5 The competitive equilibrium

The representative investor maximizes utility subject to the supply constraints:

$$
\begin{aligned}
\max_{c_{s,t},c_{n,t}} \mathbb{E} \int_0^{\infty} e^{-\rho t} \left[\pi_s^{\theta} \frac{(c_{s,t})^{1-\gamma}}{1-\gamma} + \pi_n^{\theta} \frac{(c_{n,t})^{1-\gamma}}{1-\gamma} \right] dt \\
\text{s.t.} \quad c_{s,t} \leq D_{s,t} \quad \text{and} \quad c_{n,t} \leq D_{n,t},
\end{aligned} \tag{5}
$$

where ρ is the subjective time discount factor. In equilibrium, our representative agent has to hold the entire supply of risky assets and consume the total supply of consumption/dividend. Therefore, stock returns are only determined by the investor's preferences for non-sin companies relative to sin companies.[10]

Proposition 1. *In equilibrium, the relative prices $p_{s,t}$ and $p_{n,t}$ are*

$$
p_{s,t} = \frac{\pi_s^{\theta} D_{s,t}^{-\gamma}}{\alpha \pi_s^{\theta} D_{s,t}^{-\gamma} + (1-\alpha)\pi_n^{\theta} D_{n,t}^{-\gamma}}, \qquad p_{n,t} = \frac{\pi_n^{\theta} D_{n,t}^{-\gamma}}{\alpha \pi_s^{\theta} D_{s,t}^{-\gamma} + (1-\alpha)\pi_n^{\theta} D_{n,t}^{-\gamma}}. \tag{6}
$$

Moreover, $\frac{\partial p_{s,t}}{\partial (D_{s,t}/D_{n,t})} < 0$, $\frac{\partial p_{n,t}}{\partial (D_{s,t}/D_{n,t})} > 0$, *and*

- *If* $\theta < 0$, $\frac{\partial p_{s,t}}{\partial (\pi_n/\pi_s)} > 0$ *and* $\frac{\partial p_{n,t}}{\partial (\pi_n/\pi_s)} < 0$*;*
- *If* $\theta > 0$, $\frac{\partial p_{s,t}}{\partial (\pi_n/\pi_s)} < 0$ *and* $\frac{\partial p_{n,t}}{\partial (\pi_n/\pi_s)} > 0$*.*

Proof. See Appendix A. □

The equilibrium prices of sin and non-sin stocks are given in the proposition below.

Proposition 2. *In equilibrium, the stock price of asset $i \in \{s, n\}$ is*

$$
S_{i,t} = \frac{p_{i,t} D_{i,t}}{\Gamma_i},
$$

where $\Gamma_i := \rho + (\gamma - 1)\left(\nu_i - \frac{\phi_i^2}{2}\right) - \frac{1}{2}(1-\gamma)^2 \phi_i^2$.

[10] A similar assumption is made by Dam and Heijdra (2011), who build a general equilibrium model where agents invest in "clean" assets and "dirty" assets (i.e., assets issued by firms that pollute).

Proof. See Appendix A. □

Using the equilibrium prices in Proposition 2, we obtain the (log) price differential between sin and non-sin stocks

$$\log(S_{s,t}) - \log(S_{n,t}) = \theta[\log(\pi_s) - \log(\pi_n)] + (1-\gamma)[\log(D_{s,t}) - \log(D_{n,t})] \\ + \log(\Gamma_n) - \log(\Gamma_s). \tag{7}$$

The right-hand side of equation (7) depends on the firms' ethicalness, current dividend payments, and dividend fundamentals.[11] By assumption, $\log(\pi_s) - \log(\pi_n) < 0$. Therefore, $\theta > 0$ (< 0) implies that, all other things being equal, sin companies are worth less (more) than non-sin companies.

To understand why, consider $\theta > 0$ (< 0). The marginal utility of consumption increases (decreases) with the perceived degree of ethicalness π_i, making the dividends paid by non-sin companies worth more (less) than those paid by sin companies. Hence, non-sin stocks are more (less) expensive than sin stocks.

The second term on the right-hand side of equation (7), instead, captures diversification effects. Here, an increment in the dividend paid by sin companies increases the expected cash-flow of sin companies (as compared to that of non-sin companies), giving rise to two opposite forces. On the one hand, this makes sin companies more profitable, boosting investors' demand for such stocks and raising their price.

On the other hand, increasing the share of sin dividends changes the composition of the investors' cash-flows basket. Risk averse investors would prefer to hold a diversified cash-flows basket and, to restore their desired balance between the two cash-flows, they would reduce their demand of sin stocks (i.e., reduce the sin cash-flows) and increase the demand of non-sin stocks (i.e., increase the non-sin cash-flows). As a result, the price

[11] In our analysis, we set $\Gamma_s > 0$ and $\Gamma_n > 0$. These two constants depend on the dividend fundamentals only, and in our benchmark calibration we set $\Gamma_s = \Gamma_n$ (see Section 3).

differential between sin and non-sin stocks decreases.

This trade-off is governed by the risk aversion parameter γ. For $\gamma > 1$, the diversification effect is dominant and the price differential in equation (7) declines when the dividend share of sin stocks increases. Vice versa, for $\gamma \in (0, 1)$ the profitability effect is dominant and the stock price differential rises as the dividend share of sin stocks increases.[12]

The complementarity between dividend and ethicalness also has important implications for the conditional return spread between sin and non-sin stocks.

Proposition 3. *In equilibrium, the return spread between the sin and non-sin stocks is*

$$\mu_{s,t} - \mu_{n,t} = \gamma(1-\gamma)\left[\alpha p_{s,t}\phi_s^2 - (1-\alpha)p_{n,t}\phi_n^2\right]. \tag{8}$$

Moreover, if $\gamma > 1$ ($\gamma \in (0, 1)$) the return spread is an increasing (decreasing) function of the dividend share $d_{s,t}$.

Proof. See Appendix A. □

The return spread (8) decreases with the dividend share $d_{s,t}$ if $\gamma \in (0, 1)$, and increases otherwise. This result hinges on the trade-off between the discount rate channel and the cash-flow channel illustrated in equation (7).

The conditional return spread between sin and non-sin stocks also depends on firms' ethicalness. Given the empirical evidence, one would expect that the return spread (8)

[12] This trade-off can be verified by looking at the equilibrium value of the firm's dividend, $\lambda_t p_{i,t} D_{i,t}$. Note that $\partial \lambda_t p_{i,t} D_{i,t} / \partial D_{i,t}$ is the sum of two quantities: (i) $[\partial(\lambda_t p_{i,t})/\partial D_{i,t}]D_{i,t} < 0$ (the discount rate effect) and (ii) $\lambda_t p_{i,t} > 0$ (the cash-flow effect). Thus, an increase in the share of sin dividends increases the value of sin dividends and, at the same time, decreases the discount rates applied to dividends of sin companies relative to that applied to dividends of non-sin companies (i.e., $\lambda_t p_{s,t}$ decreases relative to $\lambda_t p_{n,t}$). For $\gamma > 1$ ($\gamma \in (0, 1)$), the discount rate rises faster (slower) than cash-flows, so the price of sin stocks decreases (increases) relative to the price of non-sin stocks. It is easy to check that $\lambda_t p_{i,t} D_{i,t} = e^{-\rho t}\pi_i^\theta D_{i,t}^{1-\gamma}$ is decreasing (increasing) in $D_{i,t}$ if $\gamma > 1$ (< 1). When $\gamma = 1$, the effects from the discount rate and the cash-flow exactly offset each other and dividend payments do not affect stock prices.

increased with the relative degree of ethicalness ξ_s, i.e., $\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial \xi_s} > 0$. Since $\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial \xi_s} > 0 \Leftrightarrow \frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial \pi_n/\pi_s} > 0$, we focus on this latter condition. Results in Proposition 1 imply

$$\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial(\pi_n/\pi_s)} = (1-\gamma)\gamma\Big[\alpha\frac{\partial p_{s,t}}{\partial(\pi_n/\pi_s)}\phi_s^2 - (1-\alpha)\frac{\partial p_{n,t}}{\partial(\pi_n/\pi_s)}\phi_n^2\Big].$$

Therefore, the following cases may occur.

1. $\theta = 0$ and/or $\gamma = 1$: in this case, $\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial(\pi_n/\pi_s)} = 0$ and the firms' ethicalness has no impact on stock returns.
2. $\theta < 0$: in this case, $\frac{\partial p_{s,t}}{\partial(\pi_n/\pi_s)} > 0$ and $\frac{\partial p_{n,t}}{\partial(\pi_n/\pi_s)} < 0$ (Proposition 1) and thus

$$\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial(\pi_n/\pi_s)} \quad \begin{cases} < 0 \text{ if } \gamma > 1 \\ > 0 \text{ if } \gamma \in (0,1). \end{cases}$$

3. $\theta > 0$: in this case, $\frac{\partial p_{s,t}}{\partial(\pi_n/\pi_s)} < 0$ and $\frac{\partial p_{n,t}}{\partial(\pi_n/\pi_s)} > 0$ (Proposition 1) and thus

$$\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial(\pi_n/\pi_s)} \quad \begin{cases} < 0 \text{ if } \gamma \in (0,1) \\ > 0 \text{ if } \gamma > 1. \end{cases}$$

In summary, the return spread (8) increases with the ratio π_n/π_s (or equivalently with the relative degree of ethicalness ξ_s) if $\theta < 0 \wedge \gamma \in (0,1)$ or $\theta > 0 \wedge \gamma > 1$.

To understand the results above, consider the differential of the utility function (2), with respect to π_i and c_i, with $i \in \{s, n\}$

$$dU = \frac{\theta}{1-\gamma}\pi_i^{\theta-1}c_i^{1-\gamma}d\pi_i + \pi_i^{\theta}c_i^{-\gamma}dc_i. \tag{9}$$

Whereas an increment of dividend payments (i.e., $dc_i > 0$) always causes an increase of utility, the effect of an increase in firm's ethicalness (i.e., $d\pi_i > 0$) depends on the sign of $\frac{\theta}{1-\gamma}$. If $\frac{\theta}{1-\gamma} < 0$, investors may face a potential loss if they do not offset the change in firm's ethicalness by increasing the consumption of the good that has now become more ethical. If $\frac{\theta}{1-\gamma} > 0$, investors may prefer to decrease the consumption of the good whose ethicalness increment has already raised their utility.

The investors' incentives to adjust consumption according to firm's ethicalness are summarized by the marginal rate of substitution (MRS_i) between dividend and ethicalness of firm i, which measures the change in consumption needed to maintain the utility constant (i.e., $dU = 0$) after a change in firm's ethicalness

$$MRS_i = \frac{dc_i}{d\pi_i} = -\frac{\theta}{1-\gamma}\frac{c_{i,t}}{\pi_i} = A\frac{c_{i,t}}{\pi_i}. \tag{10}$$

The key point is the sign of the constant $A = -\frac{\theta}{1-\gamma}$. $A > 0$ if either $\theta < 0 \wedge \gamma \in (0,1)$ or $\theta > 0 \wedge \gamma > 1$. In both cases, the investors would incur a utility loss if they do not increase consumption in reaction to an increase in firm's ethicalness. This is so either because they have high desire of consumption smoothing ($\gamma > 1$) and the consumption of ethical dividends is relatively more valuable ($\theta > 0$), or because diversification incentives are weak ($\gamma \in (0,1)$) and the consumption of sin dividends is relatively more valuable ($\theta < 0$).[13] When one of these cases occurs, then investors would like to receive higher dividends if the degree of ethicalness increases.

However, investors have no influence on firms' ethicalness and dividend payments, which are both decided by firms. When $A > 0$, investors will ask for a premium as a reward for the risk of holding large dividends received from firms with a low degree of ethicalness. This explains why sin companies tend to pay, ceteris paribus, higher returns than non-sin companies when $\theta < 0 \wedge \gamma \in (0,1)$ or $\theta > 0 \wedge \gamma > 1$. Conversely, if $A < 0$,

[13]Intuitively, when $\gamma > 1$ diversification motives gain in importance. Thus, failing to smooth consumption in reaction to changes in the marginal utility, induced by an increase in firm's ethicalness, causes a loss in utility which has to be compensated by increasing the consumption of non-sin dividends. When $\gamma \in (0,1)$, investors have weak incentives to adjust consumption in reaction to change in the marginal utility and the utility loss is induced by the fact the non-sin dividends are relatively less valuable ($\theta < 0$).

similar arguments apply to explain the rise of an ethical premium. Such a result arises if either $\theta < 0 \wedge \gamma > 1$ or $\theta > 0 \wedge \gamma \in (0,1)$. In these two cases, sin stocks will display on average lower returns than non-sin stocks.[14]

Our theoretical setting allows us to obtain predictions also on the behavior of the volatility spread between the sin and non-sin stocks with respect to the dividend share.

Proposition 4. *In equilibrium, the volatility spread between the sin and non-sin stocks is*

$$\sigma_{s,t} - \sigma_{n,t} = \sqrt{[1-(1-\alpha p_{s,t})\gamma)]^2\phi_s^2 + [(1-\alpha p_{s,t})\gamma\phi_n]^2} - \sqrt{(\alpha\gamma p_{s,t}\phi_s)^2 + [(1-\alpha\gamma p_{s,t})\phi_n]^2}.$$

Moreover, if $\gamma > 1$ ($\gamma \in (0,1)$), then the volatility spread is an increasing (decreasing) function of the dividend share $d_{s,t}$.

Proof. See Appendix A. □

In Section 4, we empirically study the behavior of the return and volatility spread with respect to the dividend share. Our analysis pins down the set of possible values of parameters γ and θ such that the predictions in Propositions 3 and 4 are simultaneously supported by the data.

2.6 Ethicalness vs. boycott

In this section, we show to what extent our approach is capable of overcoming some limitations of the boycott-based models. As the benchmark in the boycott literature, we consider the recent model of Luo and Balvers (2017).

Luo and Balvers (2017) build a static model with q_R restricted (ethical) investors who refuse to invest in sin stocks and q_U unrestricted investors who invest in both sin and

[14]The mechanism described here builds on investors' diversification motives. The role of diversification in explaining the return differential between sin and non-sin companies has also been emphasized in alternative theoretical frameworks (Albuquerque, Koskinen, and Zhang, 2018; Baker, Hollifield, and Osambela, 2018).

non-sin stocks. These two groups of investors are endowed with initial wealth $\bar{w}_R$ and $\bar{w}_U$, respectively. They decide how to allocate their wealth between risky assets and a risk-free asset with return $1 + r_f$ to maximize utility of terminal wealth $U(w_R)$ and $U(w_U)$. In equilibrium, the price of sin stocks (S_s) and the price of non-sin stocks (S_n) are

$$S_s = \frac{\bar{x}_s - \chi_1 \left(\sigma_{ns} N_n + \sigma_s^2 N_s\right) - \chi_2 \left(\sigma_{ns} N_{1,b} + \sigma_s^2 N_{2,b}\right)}{1 + r_f} \tag{11}$$

$$S_n = \frac{\bar{x}_n - \chi_1 \left(\sigma_n^2 N_n + \sigma_{ns} N_s\right) - \chi_2 \left(\sigma_n^2 N_{1,b} + \sigma_{ns} N_{2,b}\right)}{1 + r_f}, \tag{12}$$

where $\bar{x}_i$ is the expected cash flow of firm i, σ_i^2 the variance of cash flows of firm i, and $\sigma_{i,j}$ the co-variance between cash flows for $i, j = \{s, c\}$. N_i is the number of firm i's available shares. Moreover, $\chi_1 = \frac{1}{q_R \bar{w}_R / \rho_R + q_U \bar{w}_U / \rho_U}$, $\chi_2 = \chi_1 \frac{q_R \bar{w}_R / \rho_R}{q_U \bar{w}_U / \rho_U}$, $\rho_R = \frac{\mathbb{E}\left[U''(w_R)\right]}{\mathbb{E}\left[U'(w_R)\right]} \bar{w}_R$, $\rho_U = \frac{\mathbb{E}\left[U''(w_U)\right]}{\mathbb{E}\left[U'(w_U)\right]} \bar{w}_U$, $N_{1,b} = -\frac{\sigma_{ns}}{\sigma_n^2} N_s$ and $N_{2,b} = N_s$.

The driving forces of the sin premium. To illustrate how the sin premium emerges from equations (11) and (12), consider a symmetric economy where cash flows follow the same process (i.e., $\bar{x}_s = \bar{x}_s = \bar{x}$ and $\sigma_s^2 = \sigma_n^2 = \sigma^2$) and are uncorrelated ($\sigma_{ns} = 0$), and where the two stocks have the same number of shares (i.e., $N_s = N_n = N$). We have

$$S_s = \frac{\bar{x} - \chi_1 \sigma^2 N - \chi_2 \sigma^2 N_{2,b}}{1 + r_f},$$

$$S_n = \frac{\bar{x} - \chi_1 \sigma^2 N}{1 + r_f}.$$

The price of the sin stock is reduced by the term $\chi_2 \sigma^2 N_{2,b}/(1+r_f) > 0$. Most importantly, the term $\chi_2 \sigma^2 N_{2,b}$ is different from zero if $\chi_2 > 0$, that is, when $q_R > 0$. In other words, ceteris paribus, the presence of investors who refuse to hold sin stocks reduces their price (i.e., $S_s < S_n$) and increases their expected returns, as compared to non-sin stocks (i.e., $R_s = \frac{\bar{x}}{S_s} > R_n = \frac{\bar{x}}{S_n}$). In this framework, restricted investors always refuse to hold sin stocks, independently of their expected cash-flows.

Therefore, the boycott-based approach leaves no room for a trade-off between ethicalness and cash-flows, even when the latter become more appealing. Conversely, the pricing equations in Proposition 2 encapsulate such a trade-off, which arises as the result of two opposite forces, i.e., the desire for diversification and the desire for ethicalness.

Time-variation in expected returns. As evident from equations (11) and (12), stock returns are constant. Boycott-based models are, in fact, designed to explain only the average returns differential between sin and non-sin stocks, while remaining silent about how the dividend share of sin stocks affects both the stock returns and their volatility over time. In this respect, Luo and Balvers (2017) show that the conditional version of their boycott-based model is rejected by the data.

In our model average returns and their volatility are time-varying and explicitly depend on the dividend share of sin stocks (Propositions 3 and 4). This gives rise to a set of testable predictions.

Empirical tests. In the boycott-based model, stock returns depend on the number of restricted and unrestricted investors, and on the wealth they own. But the number of restricted/unrestricted investors and their wealth are not directly observable. Therefore, the empirical tests of model predictions are typically based on proxies such as the restricted wealth ratio of Luo and Balvers (2017), which is computed using the investment strategy of mutual funds.

In contrast, the return/volatility differentials in our model depend on dividend payments, which are more easily observable. Yet, in Section 4.6 we augment our tests to account for the role of the restricted wealth ratio of Luo and Balvers (2017).

3 Calibration

To assess whether our framework is capable of providing a realistic description of the return spread between sin and non-sin stocks, we first need to calibrate the model.

We consider a symmetric economy where the two firms have the same fundamentals (i.e., $\nu_s = \nu_n$ and $\phi_s = \phi_n$) and only differ in the realized dividend payments. To calibrate the dividend process, we use the average growth rate and the standard deviation of the total payout of sin and non-sin companies (see Table 3 below). Empirical estimates suggest that $\nu_s = 4 \times 0.010$, $\nu_n = 4 \times 0.006$, $\phi_s = \sqrt{4} \times 0.156$, and $\phi_n = \sqrt{4} \times 0.098$. We then take the mean of these estimates, namely we set $\nu_s = \nu_n = \frac{4\times 0.010+4\times 0.006}{2}$ and $\phi_s = \phi_n = \frac{\sqrt{4}\times 0.156+\sqrt{4}\times 0.098}{2}$. We then choose weights $\alpha = 1 - \alpha = 0.5$.

The model's predictions also depend on relative ethicalness $\xi_s = \frac{\pi_s}{\pi_s+\pi_n}$. The only restriction is $\pi_s < \pi_n$, which implies $0 \leq \xi_s \leq 0.5$. Therefore, to analyze conditional moments, we consider three values of relative ethicalness $\xi_s = \{0.1, 0.3, 0.5\}$. When computing average returns, we use $\xi_s = 0.3$.

Concerning the preference parameters θ and γ, we look at a range of parameters selected to illustrate the economic mechanism at work in the model. We should observe different patterns of returns depending on whether $\theta < 0 \wedge \gamma \in (0, 1)$ or $\theta > 0 \wedge \gamma > 1$. As we consider risk averse agents, the natural lower bound for the risk aversion parameter γ is 0. We use two values of γ, namely $\gamma = 0.5$ and $\gamma = 3$, which are in line with the usual estimates of risk aversion (see Benartzi and Thaler, 1995; Bliss and Panigirtzoglou, 2004).

Because there are no available estimates of θ, the parameter governing the complementarity between dividends and ethicalness, we select a wide range of values centered at zero ($\theta \in \{-20, -19, \ldots, 19, 20\}$) to show how the behavior of stock returns varies with the magnitude and the sign of θ.[15]

[15]In Appendix B, we calibrate an asymmetric economy where the parameters are set equal to their

We simulate 5,000 trajectories of dividends, each of 50-year length. For any value of simulated dividends $D_{s,t}$ and $D_{n,t}$, we compute the conditional returns and the conditional volatility. The unconditional return is computed as the average of conditional returns. The same applies to the volatility.

3.1 Properties of stock return and stock volatility

Figure 1 (high risk aversion case: $\gamma = 3$) and Figure 2 (low risk aversion case: $\gamma = 0.5$) show the conditional return and volatility spreads between sin and non-sin stocks as a function of the dividend share of sin stocks, which we denote as $d_{s,t} = \frac{D_{s,t}}{D_{s,t}+D_{n,t}}$. The closed form expressions for these spreads are reported in Propositions 3 and 4, respectively.

When investors are more risk averse than log utility, diversification motives are more important than profit opportunities. Here, an increase in the dividend share $d_{s,t}$ reduces the current price of sin stocks relative to the price of non-sin stocks, raising future expected returns of sin stocks as compared to that of non-sin stocks (Figure 1). The opposite scenario takes place when the agents are less risk averse than log utility (Figure 2). In equilibrium, investors expect higher returns from riskier stocks than from safer stocks. The positive relationship between risk and return implies that the return and volatility spread are both monotonically increasing (high risk aversion) or decreasing (low risk aversion) with the dividend share $d_{s,t}$.

A novel aspect in our framework relates to the effects of the perceived ethicalness, summarized by the relative variable $\xi_s = \frac{\pi_s}{\pi_s+\pi_n}$, on the return and volatility spreads between sin stocks and non-sin stocks. We observe that when $\theta < 0 \wedge \gamma \in (0, 1)$ or $\theta > 0 \wedge \gamma > 1$, sin stocks are riskier than non-sin stocks (i.e., they exhibit higher standard deviation) and command higher returns over most of the dividend share region.

In Table 1, we then study the implications of dividend/ethicalness complementarity

empirical counterparts and $\alpha = .18$ according to the average dividend share of sin companies (see Panel C of Table 3 below). We obtain results very similar to the symmetric case.

(θ) and risk aversion (γ) for the average return and volatility differential between sin and non-sin stocks. Because of the joint effect of θ and γ on the marginal rate of substitution between dividends and firm's ethicalness, sin stocks are more volatile than non-sin stocks and pay, on average, higher returns than non-sin stocks when (i) dividend and ethicalness are substitutes ($\theta < 0$) and $\gamma \in (0, 1)$, or (ii) when dividend and ethicalness are complements ($\theta > 0$) and $\gamma > 1$. The results are similar for the symmetric (Panel A) and the asymmetric economy (Panel B).

The calibration exercise reported in Table 2 shows that our model also produces reasonable values for sectoral stock returns, market-wide stock returns and volatilities, and the risk-free rate even for very low values of γ and when $|\theta|$ is small.[16] Overall, the most reasonable match of aggregate quantities is achieved for $\gamma > 1$ (as low as $\gamma = 1.1$) and $\theta \in [-3, 3]$. As we show later, the conditional moments of the sin premium are reproduced by $\gamma > 1$ and $\theta > 0$. Hence, the joint behavior of sectoral and aggregate returns can be well described by $\gamma > 1$ and $\theta \in (0, 3]$.

Finally, one may wonder whether the previous results are affected by the relative size of the sin sector. In our framework, a proxy for the size of the sin sector is given by the dividend (consumption) share of the sin sector. By inspection of Figure 1, we see that the shape of the return and volatility spreads does not depend on the dividend share (and thus on the relative size of the sin sector) but only on the preference parameters. This suggests that even a more complicated model with N sectors would generate the same qualitative results as the model depicted above.

[16]Our two-sector model performs well in this respect because sectoral returns, and therefore aggregate returns, change over time as a function of the dividend share of the two sectors. In contrast, in a standard one-sector economy with power utility returns are a constant fraction of γ and, as a result, one typically needs large values of γ to obtain realistic values for expected returns and volatilities. The aggregate stock market volatility tends to be high when θ is large in absolute value. In this case, the ratio between the marginal utilities of the two consumption goods tends to be either high or low, on average, depending on the sign of θ (see Appendix A, proof of Proposition 1). In other words, θ drives up the wedge between the two consumption goods' marginal utilities. The larger this wedge, the stronger the desire of rebalancing and the higher the aggregate stock market volatility are.

4 Empirical analysis

4.1 Data

We consider U.S. firms traded on NYSE, AMEX, and NASDAQ between 1926 and 2015, and obtain monthly total stock return data from the Center for Research in Security Prices (CRSP) and accounting data from Standard & Poor's Compustat. We require each firm to have traded ordinary shares (CRSP share code 10 or 11). Data on institutional ownership between 1980 and 2015 are from Thomson Reuters 13F and S12. Data on portfolio choices of retail investors between 1991 and 1996 are from a large discount brokerage (LDB) firm, as in Barber and Odean (2000, 2001, 2002). We also obtain consumer price index (CPI) series from Federal Reserve Economic Data (FRED) of the St. Louis Federal Reserve Bank, risk factors (excess market return, small minus big, high minus low, and momentum) and industry returns from Kenneth French's website, and the liquidity factor from Robert Stambaugh's website.

4.2 Portfolio construction and summary statistics

Our sin portfolio, in line with Hong and Kacperczyk (2009), includes companies producing alcoholic beverages, smoke products, and gaming. In addition, we construct an extended sin portfolio that also includes companies involved in the distribution of sin products. The non-sin portfolio includes companies operating in the food, soda, fun, and meals industries. The sin portfolio and the extended sin portfolio comprise 235 and 408 companies, respectively. The non-sin portfolio contains 1,943 companies. We compute value-weighted real returns on these portfolios at the quarterly frequency.[17] For robustness, we also compute equally-weighted returns. We provide details on the portfolio construction procedure in Appendix C.1.

[17] In line with Bansal, Dittmar, and Lundblad (2005a) and Bansal, Fang, and Yaron (2005b), we use data at the quarterly frequency, which allows us to better remove seasonal patterns from the time-series of dividend payments.

We conduct our baseline analysis over the period 1965Q1:2015Q4. Indeed, it was in 1965, amid growing health concerns about smoking, that the Congress passed the Federal Cigarette Labeling and Advertising Act, which substantially restricted cigarette packaging practices (Hong and Kacperczyk, 2009). This can be seen as a turning point in social norms about smoke products, after which companies operating in that industry can be unambiguously classified as sinful. We also conduct robustness tests using the whole sample period 1926Q3:2015Q4.

In Table 3, we analyze the returns of the sin portfolio vis-à-vis the non-sin portfolio. The average quarterly excess return on the sin portfolio is equal to 2.3% (Panel A), while the average equally-weighted quarterly excess return on the non-sin portfolio is equal to 1.7% (Panel B). The sin portfolio exhibits a higher standard deviation than that of the portfolio of non-sin companies (12.0% vs 11.2%). The differential return of sin stocks is even larger for value-weighted portfolios (3.8% vs. 2.9% quarterly), while the difference in the standard deviation is similar to the case of equally-weighted portfolios (9.5% vs. 8.7%). Hong and Kacperczyk (2009) find similar results during the period 1965-2005.[18]

The main variable of interest is the dividend share of sin companies ($d_{s,t}$). We measure dividend payments at monthly frequency from CRSP adjusting for stock repurchases (Bansal et al., 2005a). We then convert these dividend payments to quarterly frequency by summing monthly payments within each quarter. To mitigate seasonal effects, we take the trailing four-quarter average as in Bansal et al. (2005a). Figure 3 shows the evolution of the dividend share of the sin portfolio through time, both for repurchase-adjusted dividend payments (left graph) and dividend-only payments (right graph). The summary statistics for these two measures of dividend share are provided in Panel C of

[18]Existing evidence on the sin premium is heterogeneous across countries. In the U.S. and in Europe, institutional investors tend to underweight sin stocks, which pay higher returns than non-sin stocks. By contrast, in other countries, such as some in the Asia Pacific region, non-sin companies pay higher risk-adjusted returns even though institutional investors underweight sin stocks (Phillips, 2011; Durand, Koh, and Tan, 2013; Fauver and McDonald, 2014). We examine international heterogeneity in Appendix C.2.

Table 3.

Finally, Panel D provides information on institutional ownership for sin and non-sin stocks. Among sin stocks, we distinguish among companies belonging to the top decile of institutional ownership in a given period vs. all the others. The average share of equity of sin companies held by institutional investors is 35.5%, with high (low) institutional ownership companies exhibiting an average of 73.4% (31.7%). Because institutional investors may be more prone to boycott behavior (Luo and Balvers, 2017) than to trading off dividends against ethicalness, below we exploit such a cross-sectional variation to verify if the correlation patterns predicted by our model are more clearcut among sin stocks with relatively high retail ownership. However, as one would expect, sin stocks with high institutional ownership tend to be substantially larger (in terms of market capitalization). To avoid picking up a mere size effect, below we thus use a size-adjusted measure of institutional ownership to create the high and low institutional ownership portfolios, in the spirit of Nagel (2005).

4.3 Main results

This *prima facie* evidence suggests that in the U.S. sin companies pay on average higher returns than non-sin companies and are characterized by higher volatility. Using the calibration above, the model generates positive average return and volatility spreads between sin and non-sin stocks under two different preference specifications:

(i) Dividends and ethicalness are substitute goods and risk aversion is low (lower than log utility), and

(ii) Dividends and ethicalness are complementary goods and risk aversion is sufficiently high (higher than log utility).

However, case (i) and case (ii) have opposite predictions when it comes to conditional moments. More precisely, the conditional return and volatility spread between sin and non-sin stocks are decreasing (increasing) with the dividend share of sin companies in case (i) ((ii)).[19] Therefore, we can distinguish between these two cases by looking at the empirical relation between conditional expected return and volatility spreads and the dividend share of sin companies. To do so, we estimate the following predictive regressions for the return spread over different investment horizons k:

$$\sum_{j=1}^{k} (r_{s,t+j} - r_{n,t+j}) = b_0 + b_1 d_{s,t} + \varepsilon_{t+k}. \tag{13}$$

$r_{i,t+j}$ is the one-period return for portfolio i at time $t+j$, where $i \in \{s, n\}$. $d_{s,t}$ is the current dividend share of sin companies. Besides the predictive regressions, we estimate contemporaneous regressions, where the dependent variable is $r_{s,t} - r_{n,t}$. We allow for serial correlation and heteroskedasticity in the error terms using Newey-West standard errors (four lags).

We estimate a similar regression specification for the volatility spread, namely

$$\sigma_{s,t+k} - \sigma_{n,t+k} = b_0 + b_1 d_{s,t} + \varepsilon_{t+k}, \tag{14}$$

where portfolio i's return volatility is given by the sum of the absolute value of deviations from the unconditional mean return, i.e., $\sigma_{i,t+k} = \sum_{j=0}^{k} |r_{i,t+j} - \bar{r}_i|$ for $i \in \{s, n\}$, in line with Bansal et al. (2005b).[20] We also estimate the contemporaneous specification, where the dependent variable is simply $|r_{i,t} - \bar{r}_i|$. For robustness, we use a measure based on squared deviations from the unconditional mean return, i.e., $\tilde{\sigma}_{i,t+k} = \sqrt{\sum_{j=0}^{k} (r_{i,t+j} - \bar{r}_i)^2}$ for $i \in \{s, n\}$.

To recap, our empirical strategy proceeds in two steps. First, we estimate the average return and volatility spreads without conditioning on the sin dividend share (uncondi-

[19] See Propositions 3 and 4.

[20] Note that $\bar{r}_i$ is estimated over the entire time-series available, i.e., starting from 1926Q3.

tional moments).

Second, we condition on the dividend share quantity by estimating equations (13) and (14). The parameter of interest is b_1. If the positive unconditional spreads were generated by a preference specification where dividends and ethicalness are substitute goods and investors have low risk aversion (case (i)), we would expect to find a negative relation between the dividend share of sin companies and return/volatility spreads, that is $b_1 < 0$. Conversely, if the unconditional spreads were generated by a preference specification where dividends and ethicalness are complementary goods and investors have high risk aversion (case (ii)), we would expect $b_1 > 0$.

Table 4 reports the main tests of the unconditional and conditional predictions of the model. Panel A considers our baseline case, namely return and volatility spreads between sin and non-sin companies using value-weighted returns over the period 1965Q1:2015Q4. Panel B relies on equally-weighted returns. Panel C repeats the analysis using the extended sin portfolio. Panel D uses data at the annual frequency.

To verify the unconditional predictions, we compute the mean return and volatility spreads between the sin and the non-sin portfolio over different investment horizons (contemporaneous, one year, and three years) and test if their are statistically different from zero, using both t-tests and a likelihood ratio (LR) test reported at the bottom of the table.[21] In each case, as expected, the return and volatility differentials are positive at all horizons. While the return spread is in some instances insignificant, the volatility spread is always statistically significant in Panel A and Panel C. The volatility spread is sometimes statistically insignificant – especially according to the LR test – only in Panel B and D. However, in Panel D, where we use annual data, the number of observations drops to around 50, which may lead to low statistical power.

[21]The LR test is based on a pooled regression of the returns on the sin and the non-sin portfolio on an indicator variable Sin equal to one for the sin portfolio, and zero otherwise. The LR test compares this model against a nested model in which the coefficient on the sin indicator b_{Sin} is set to zero. Thus, the LR tests the hypothesis H_0: $b_{Sin} = 0$.

The observed positive return and volatility spreads suggest that the empirically relevant preference specifications are indeed $\theta < 0 \wedge \gamma \in (0, 1)$ or $\theta > 0 \wedge \gamma > 1$. To distinguish between them, in Table 4 we regress the return and volatility spreads on the sin portfolio dividend share $d_{s,t}$.[22] The relation between both the return and the volatility spread and the dividend share of the sin portfolio is invariably positive, and in most of the cases also statistically significant. Figure 4 plots the predicted spreads based on the coefficient estimates in Panel A over the empirically relevant range of $d_{s,t}$. Positive changes in $d_{s,t}$ are associated with positive and economically large changes in both spreads. The linear predictions broadly match the patterns of our calibration exercise in Figure 1.

These positive relations are consistent with a model where dividends and ethicalness are complementary goods, and investors are more risk averse than log. Moreover, the interplay between ethical and risk preferences seems to also importantly feed back into the volatilities.

4.4 Sharpe ratio and risk-adjusted return

As an alternative approach, rather than analyzing separately the return and risk profile of sin vs. non-sin stocks, in this section we look at risk-adjusted performance measures.

Table 5 presents estimates of specifications similar to (13), where the dependent variable is the Sharpe ratio (SR, columns 1-3) and the risk-adjusted return (RAR, columns 4-6) of the usual portfolio strategy, i.e., long on sin and short on non-sin stocks. SR is computed as the ratio of the portfolio return to its volatility, as measured by the squared deviations of the portfolio return from its unconditional mean. RAR is computed as the "alpha" from rolling regressions of the portfolio return at different horizons on the five Fama and French (2015) factors, where the rolling estimation window contains 40 quar-

[22] With a slight abuse of notation, in the regression tables we denote return and volatility spreads as $\mu_{s,t+k} - \mu_{n,t+k}$ and $\sigma_{s,t+k} - \sigma_{n,t+k}$, respectively. This allows us to encompass the contemporaneous and predictive specifications under the same notation.

ters. In each case, we find that SR and RAR are significantly positive and also display a positive and significant correlation with $d_{s,t}$.

4.5 Institutional vs. retail ownership

The preference framework in Section 2.3 is motivated by the distinction between institutional and retail investors. Institutional investors may boycott sin stocks altogether (Luo and Balvers, 2017), a behavior not captured by our model. By contrast, retail investors, in line with our model's investors, may be more inclined to invest in sin stocks trading off dividends against ethicalness.

In Table 6, we therefore exploit variation in the level of institutional ownership across sin stocks to verify whether the model's predictions are more clear-cut for sin stocks with higher retail ownership. In particular, we sort sin stocks by size-adjusted institutional ownership and create two sin sub-portfolios: one with high institutional ownership (i.e., in the top decile of sin stocks in the previous quarter) and one with low institutional ownership (other sin stocks).[23] We then compare each of the two sub-portfolios against the non-sin portfolio and estimate the specifications (13) and (14), besides the basic unconditional t-tests and LR tests.

Panel A (Panel B) shows the estimation output for the high (low) institutional ownership sin portfolio. Overall, both the unconditional and conditional results appear to be more in line with our model for those sin stocks with relatively high retail ownership.[24] For sin stocks with high institutional ownership not only the coefficient attached to divided share has a negative sign, but is not even significant for the return differential.

[23]To address the issue of correlation between institutional ownership and firm size, we follow Nagel (2005) and use the size-adjusted institutional ownership, namely the residual from a pooled OLS regression of institutional ownership on market capitalizazion at the firm-quarter level.

[24]Note that the sample starts in 1980, because institutional ownership data are only available from that year onwards. The reduced sample size may reduce the statistical power of our tests relative to the baseline analysis.

4.5.1 Micro-level evidence

It is also interesting to conduct an in-depth analysis of micro-level retail investors' portfolio choices, because of their importance for our testing framework. To this end, we resort to LDB data for the period 1991-1996, which contain information on the investment accounts of a large sample of U.S. households. We look at common equity holdings and restrict the attention to stocks for which we are able to establish a valid link to CRSP through CUSIP numbers. We remove households holding short positions at any point in time, to focus on non-sophisticated investors. We winsorize all micro-level variables at the 1st and the 99th percentile.

The goal is to verify whether retail investors treat ethicalness and dividend payments as complementary goods. An implication of such a complementarity is that retail investors should reduce their portfolios' exposure to sin stocks following increases in sin stocks' payouts. We test this conjecture by using a variety of approaches.

As a preliminary step, we visually examine the aggregate behavior of households' exposure to sin stocks against the sin dividend share. The sin dividend share $d_{s,t}$ is defined as in the main time-series tests. In Figure 5, we plot it against the aggregate weight of sin stocks $w_{s,t} = \frac{\text{Sin (\$) holdings}_t}{\text{Sin (\$) holdings}_t + \text{Non-sin (\$) holdings}_t}$. This is an aggregate measure of exposure to sin stocks by retail investors. In the left graph, we use the repurchase-adjusted sin dividend share, whereas in the right graph we focus on dividends alone. A clear negative correlation between $w_{s,t}$ and $d_{s,t}$ emerges, with pairwise correlations of -43.74% and -88.49%, respectively. This finding provides support to the complementarity between ethicalness and dividend payments.

The relation is clearer for the pure dividend measure, possibly reflecting the fact that changes in dividends (given their sticky nature) are more informative to retail investors about firms' intrinsic ability to pay cash flows in the long-run. By contrast, repurchases tend to reflect cyclical variation in firms' ability to pay cash flows (see Brav, Graham, Harvey, and Michaely, 2005). Hence, retail investors may be more likely to change their holdings in response to dividend- rather repurchase-driven changes in payout of sin stocks. Moreover, unlike professional investors, retail investors may be reluctant to tender their shares in exchange of a cash flow in stock repurchases. Brennan and Thakor (1990) offer insights as to why this may happen in the presence of uninformed and informed investors, who can be interpreted as retail and professional investors, respectively.

The relation appears to be stronger starting from 1993, the year in which the Revenue Reconciliation Act increased marginal tax rates for individuals at the high-end of the income distribution (Graham and Kumar, 2006). As argued by Graham and Kumar (2006), the tax reform may have affected dividend preferences of individuals at different points of the income distribution, with high-income ones being affected and the other unaffected. It is thus possible that sin stocks and non-sin stocks as of the early '90s were held at different intensities by high- and non-high income households, and the dynamics we observe from 1993 are a by-product of differential exposure to the tax reform. The aggregate analysis in Figure 5 is not enough to rule out such a such an interpretation. Thus, to take care of this and other potential confounding events, in the tests below we move to the household-security-quarter level. In particular, we look at how single households alter the weight of a given stock following changes in its payout yield:

$$w_{h,j,t} = b_1 \cdot d_{j,t-1} \times Sin_{j,t-1} + b_2 \cdot (r_{j,t} - r_{f,t}) + \gamma_{h,j} + \gamma_t + \epsilon_{h,j,t}. \tag{15}$$

$w_{h,j,t}$ is the weight of stock j in the portfolio of household h at the end of calendar quarter t. $d_{j,t-1}$ is a measure of a stock's lagged payout, either proxied by its repurchase-adjusted payout yield ($Payout\ yield_{j,t-1}$), or by its dividend yield ($Dividend\ yield_{j,t-1}$). $Sin_{j,t-1}$ is an indicator variable equal to one for sin stocks and zero otherwise. We interact these two variables, to study whether households react differently to payout by sin stocks relative to other stocks.[25] The parameter b_1 captures to which extent households treat sin stocks' payout differently from other stocks' when it comes to portfolio rebalancing. A negative (positive) parameter b_1 would point to complementarity (substitutability) between ethicalness and payout.

To insulate such a mechanism, we need to focus on active portfolio rebalancing by households. First, we control for a stock's excess return $(r_{j,t} - r_{f,t})$, which captures variation in portfolio weights due to pure valuation effects. Second, by including household-by-security fixed effects $\gamma_{h,j}$, we focus on time-series variation in payout rather than cross-sectional one, and capture any time invariant characteristics of households and stocks.[26] In other words, we investigate portfolio adjustments following changes in payout throughout time rather than looking at long-lasting differences in payout across stocks, which arguably inform households' stock picking. We also absorb any variation in macroeconomic conditions as well as in stock market risk factors by including time fixed effects γ_t. We allow the error term $\epsilon_{h,j,t}$ to cluster at the household-level. The estimation sample includes sin and non-sin stocks, thus the latter are the reference group.

Columns 1 and 2 of Table 7 report coefficient estimates for specification (15), using the repurchase-adjusted payout yield and the dividend yield, respectively. Whereas in column 2 the relation between weights and payout is negative also for non-sin stocks, in both columns it is significantly more negative for sin stocks. This is evidence consistent with a complementary relation between ethicalness and payout for retail investors. One limitation of these tests lies in the dependence of portfolio weights on underlying price dynamics. Whereas we control for excess stock return, it is possible that we are not only capturing households' active portfolio rebalancing.

[25] For ease of notation, in equation (15) we do not report the main terms of the interaction, $d_{j,t-1}$ and $Sin_{j,t-1}$, which are included in the estimated regression. Note that the indicator variable $Sin_{j,t-1}$ is not absorbed by household-by-security fixed effects because a handful of stocks change their sin status over the sample.

[26] Note that the LDB database does not provide time-varying household characteristics.

We tackle this problem by looking at overall LDB retail ownership as well as overall institutional ownership for a given stock, i.e., measures that do not directly depend on stock prices. Using security-quarter data, we estimate this specification:

$$y_{j,t} = b_1 \cdot d_{j,t-1} \times Sin_{j,t-1} + b_2 \cdot (r_{j,t} - r_{f,t}) + \gamma_j + \gamma_t + \epsilon_{j,t}, \tag{16}$$

where $y_{j,t}$ is either $RO\%_{j,t}$, i.e., the overall ownership of stock j by investors covered by LDB in calendar quarter t, computed as the ratio between the total number of shared held by such investors and the overall shares outstanding, or $IO\%_{j,t}$, i.e., total institutional ownership as reported by Thomson Reuters 13F.[27] All the other variables are defined as in equation (15), with the difference that we control for security – rather than household-by-security – fixed effects, and that standard errors are clustered at the security level.

Columns 3 and 4 of Table 7 show estimates of specification (16) for retail ownership. The relation between dividend yield and ownership is negative and significant only for sin stocks. The limited role of repurchases relative to dividends, in line with aggregate evidence in Figure 5, is possibly due to the stronger signaling value of dividend changes. Columns 5 and 6 repeat the same tests for institutional ownership as a "falsification test" of the results on retail ownership. We find no evidence of any complementarity between payout and ethicalness for institutional investors, which helps us to rule out the existence of a mechanical relation between retail portfolio choices and payout.

As a final note, whereas there is evidence that institutional investors – which may benefit from preferential tax treatment – tend to hold higher dividend yield stocks than retail investors (Graham and Kumar, 2006; Grinstein and Michaely, 2005), such dividend clientele explanations do not capture the different behavior of investors towards sin and non-sin stocks' payout.

[27] Given that LDB contains a relatively small number of investors relative to the whole economy, $RO\%_{j,t}$ exhibits rather low values.

4.6 Other explanations

Our theoretical model suggests that the relevant state variable to explain the return and volatility differential between the sin and the non-sin sector is the dividend share of sin companies. Here, we take into account possible alternative explanations.

Table 8 re-estimates equations (13) and (14) controlling for a vector of well-known risk factors. Panel A controls for the five factors of Fama and French (2015), momentum, traded liquidity (Pástor and Stambaugh, 2003), industry momentum (Moskowitz and Grinblatt, 1999), and industry concentration (Hou and Robinson, 2006).[28] Our baseline results remain unchanged. It is worth noting that the momentum factors also proxy for investor sentiment (Stambaugh, Yu, and Yuan, 2012). This reduces the concerns that the return and volatility spreads between sin and ethical stocks are driven by it.

Panel B, besides the risk factors above, controls for the restricted wealth ratio RWR_t by (Luo and Balvers, 2017). In each period, RWR_t is computed as the asset value of "restricted" mutual funds relative to the asset value of all mutual funds based on Thomson Reuters S12 data, where a mutual fund in a given quarter is classified as restricted if it does not hold any sin stock. By controlling for RWR_t (available from 1980 onwards), we de facto absorb pricing effects stemming from time-varying boycott behavior by institutional investors (Luo and Balvers, 2017). Again, the relation between sin and volatility spreads and the sin dividend share $d_{s,t}$ does not qualitatively change. Interestingly, we also find that RWR_t and $d_{s,t}$ exhibit a small, negative and significant correlation of 18.37%,

[28]The liquidity factor LIQ_t is available from 1968Q1, hence the reduction in sample size relative to baseline tests. In the spirit of Moskowitz and Grinblatt (1999), the industry momentum factor $INDMOM_t$ is computed as the return on an investment strategy long (short) on the top (bottom) three performing industries with quarterly rebalancing, where performance data for the Fama-French 30 industries is from Kenneth French's website. The industry concentration factor ΔHHI_t is the difference in concentration between sin and non-sin industries and is meant to capture the fact that sin industries tend to be scarcely competitive (Fabozzi et al., 2008). $HHI_{s,t}$, is computed as the mean Herfindahl index (HHI) of the constituent industries (alcoholic beverages, smoke products, gaming), averaged out over the previous three years. The HHI of each constituent industry is based on the distribution of Compustat total assets in a given year. We follow a similar procedure to compute the concentration of the non-sin industry $HHI_{n,t}$.

thus suggesting that RWR_t and $d_{s,t}$ capture different aspects of the sin premium. The negative correlation can be rationalized by the preference of institutional investors for high dividend paying stocks (Graham and Kumar, 2006; Grinstein and Michaely, 2005). When the dividend share of sin stocks rises, the number of mutual funds holding sin stocks may rise as well, thus increasing the total portfolio value of unrestricted investors (and the denominator of RWR_t) as compared to the total portfolio value of restricted investors (i.e., the numerator of RWR_t), leading to a negative correlation between $d_{s,t}$ and RWR_t.

Panel C controls also for the litigation risk differential between sin and non-sin industries (ΔLIT_t), which is available from 1996Q1.[29] In this case, $d_{s,t}$ exhibits a positive and statistically significant coefficient only at shorter investment horizons. By contrast, over longer horizons, $d_{s,t}$ is at times insignificant. However, the rather short sample period may complicate inference.

One may argue that the sin premium simply reflects sin stocks' higher exposure to risk that is not captured by the risk factors above. However, sin goods tend to exhibit a steady demand throughout the business cycle because of their addictive properties (Becker and Murphy, 1988). In Appendix C.3, we analyze the business cycle properties of sin good consumption. We consistently find that, if anything, sin goods are less cyclical than our non-sin goods and are substantially less cyclical than durable goods. Therefore, sin stocks may allow investors to reduce their exposure to market risk and receive relatively steady cash flows in recessions (i.e., in periods of high marginal utility of consumption). Such a risk channel would be difficult to reconcile with a sin premium.

Finally, in Appendix C.4 we verify the robustness of our results to using different dividend measures, a longer sample period, an alternative measure of volatility, and a different classification of gaming stocks.

[29] Litigation risk is computed as the fraction of non-missing after-tax settlement entries (Compustat item `seta`) among each porfolio's constituent companies (Luo and Balvers, 2017).

5 Conclusion

Recent studies have provided evidence on the existence of a sin premium, i.e., the excess return of sin stocks with respect to non-sin comparable stocks. Such an anomaly has been explained with the presence of boycott behavior, carried out by social responsible investors. Individual and institutional investors, however, may have significantly different incentives to undertake boycott investment strategies, as they are exposed to different social pressure.

In this paper, we take into account this key aspect and propose a general, ethical preference-based model that explains the return and volatility spread between sin and non-sin stocks. Our analysis discloses a new economic channel behind the emergence of the sin premium, namely the complementarity between dividends and ethicalness of investments, and the investors' desire for diversification. We find, theoretically and empirically, that this channel can explain the first two conditional and unconditional moments of the sin premium. Taken together, our results highlight the importance of non-monetary factors, such as firms' ethicalness, in the formation of investment decisions and assets prices.

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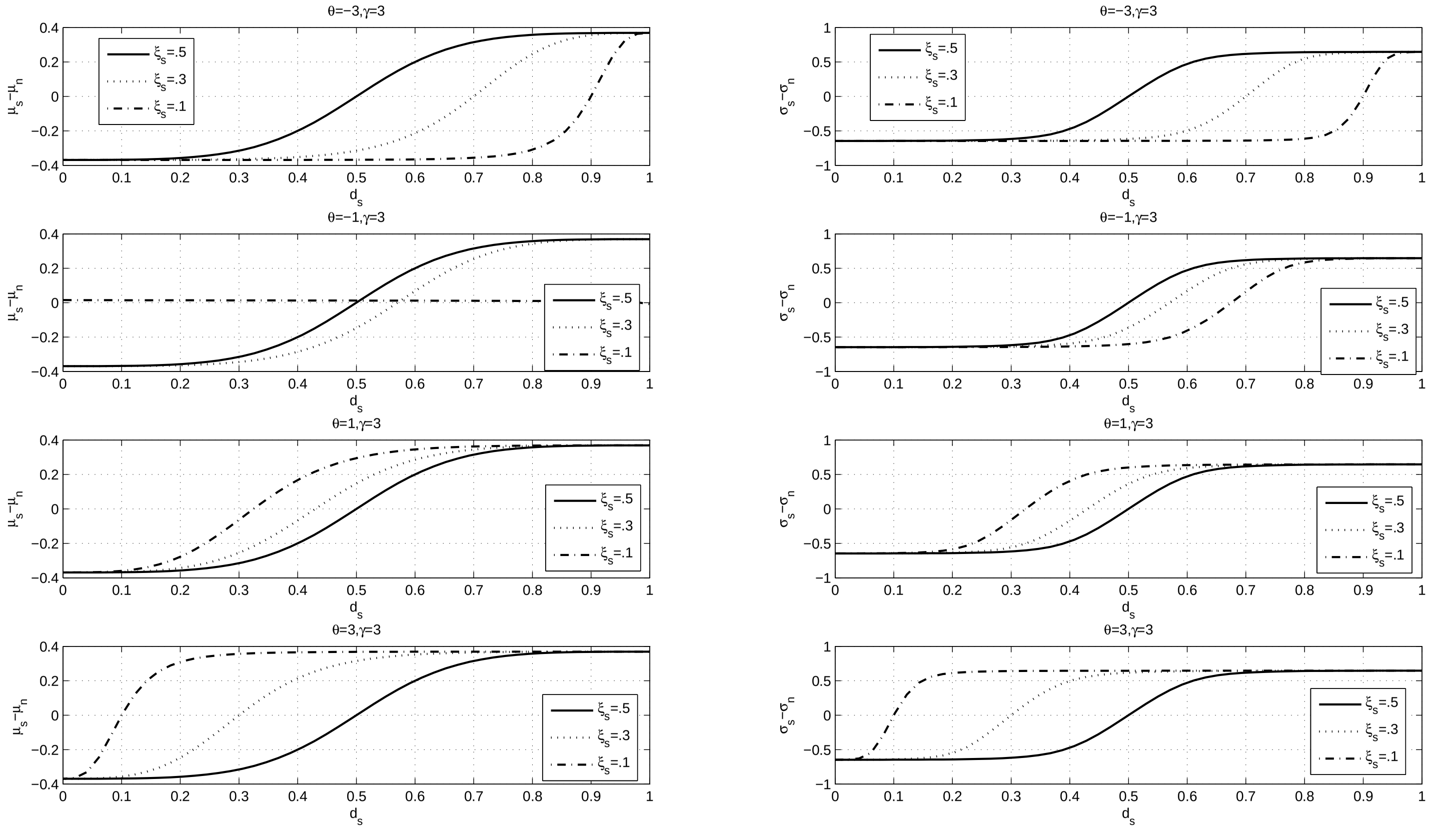

Figure 1: Conditional return and volatility spread between sin and non-sin stocks with high risk aversion. This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the non-sin stock as a function of the dividend share $d_{s,t}$ in the case of high risk aversion ($\gamma = 3$).

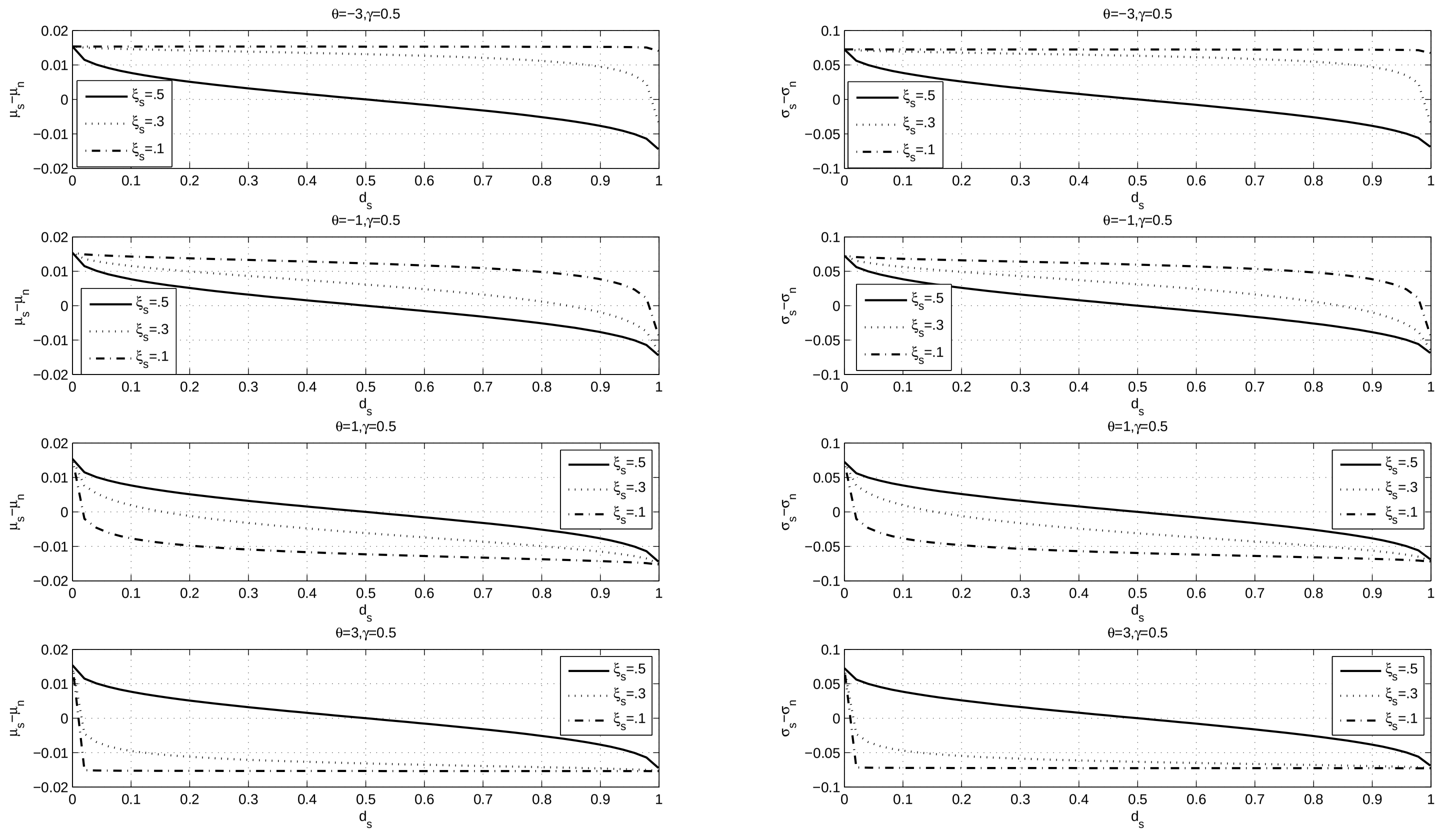

Figure 2: Conditional return and volatility spread between sin and non-sin stocks with low risk aversion. This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the non-sin stock as a function of the dividend share $d_{s,t}$ in the case of low risk aversion ($\gamma = 0.5$).

Figure 3: Dividend share of the sin portfolio. This figure plots the evolution of the dividend share of the sin portfolio through time, both for repurchase-adjusted dividend payments (left graph) and dividend-only payments (right graph).

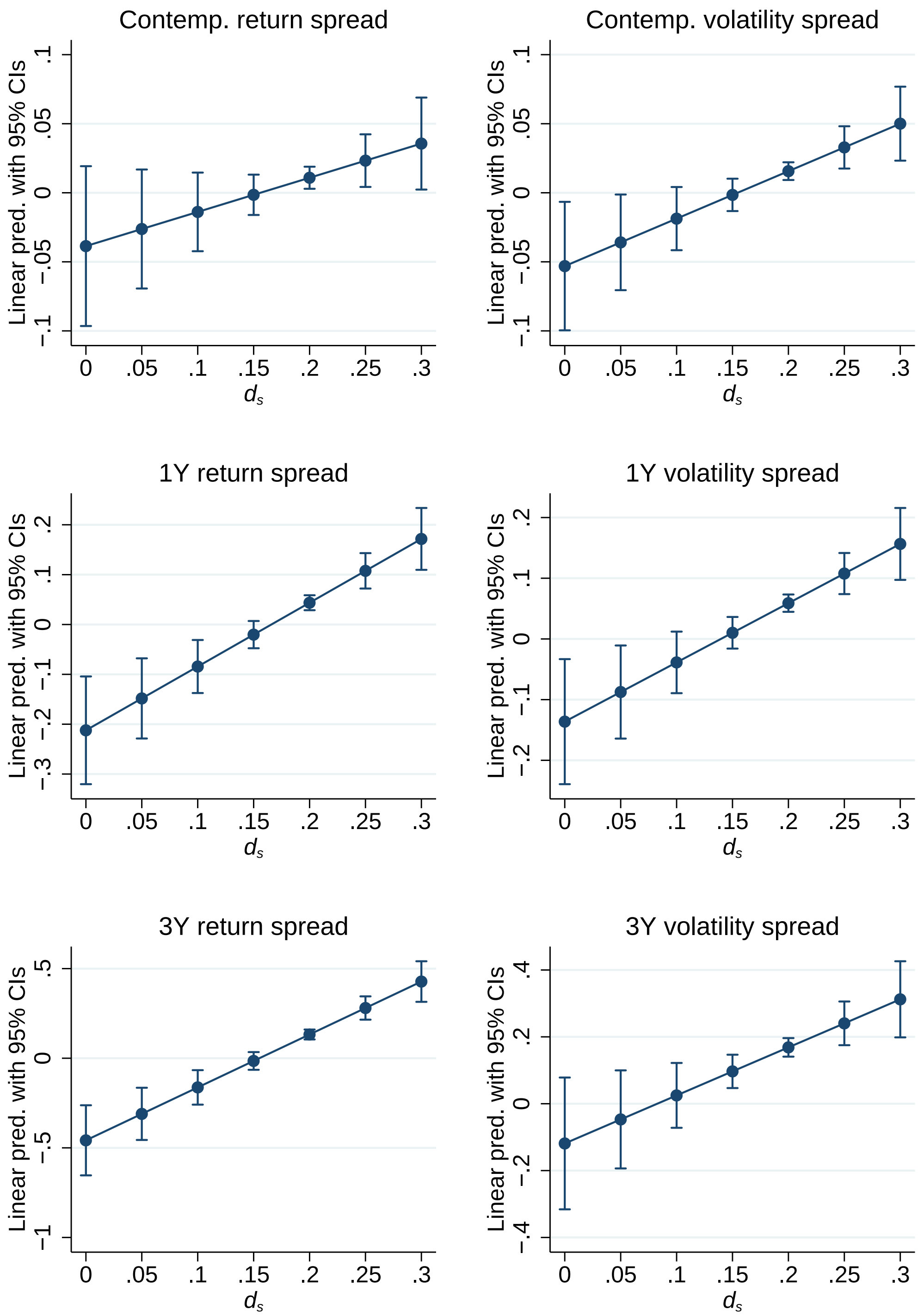

Figure 4: Predicted return and volatility spreads between sin and non-sin stocks. This figure plots the predicted return and volatility spreads between sin and non-sin stocks for given levels of the repurchase-adjusted dividend share of the sin portfolio $d_{s,t}$. The linear predictions are based on the coefficient estimates of Table 4 (Panel A).

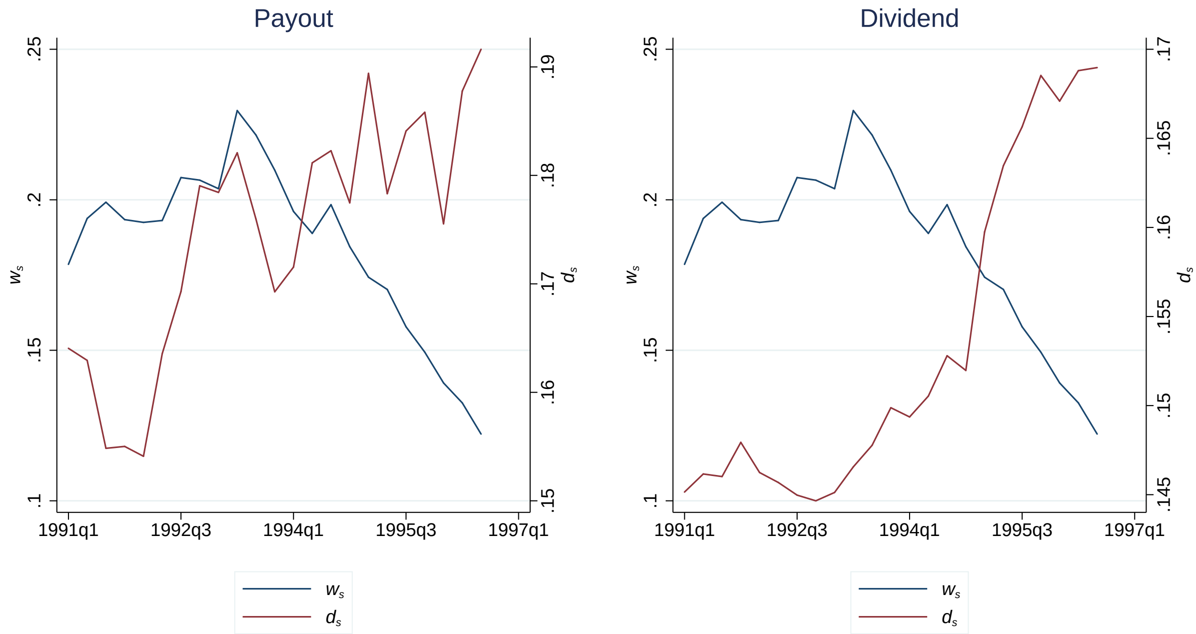

Figure 5: Retail investors' sin portfolio weight and dividend share.
This figure plots the evolution of the weight of sin stocks relative to holdings of sin and non-sin stocks in retail investors' portfolios (left axis) against the dividend share of the sin portfolio (right axis) through time, both for repurchase-adjusted dividend payments (left graph) and dividend-only payments (right graph).

Table 1: Simulated return and volatility spreads
This table reports the simulated average return and volatility spreads between sin and non-sin stocks. The spreads in Panel A are obtained under the assumption that the dividend process of the two portfolios is governed by the same parameters (symmetric calibration). The spreads in Panel B are obtained under the assumption that the dividend process of the two portfolios is governed by different parameters (asymmetric calibration based on Panel C of Table 3). $5,000$ trajectories of dividends are simulated, each of 50-year length. The return and volatility spreads are computed along these trajectories.

Panel A: Symmetric calibration

	$\mu_s - \mu_n$		$\sigma_s - \sigma_n$	
	(1) $\gamma = 0.5$	(2) $\gamma = 3$	(3) $\gamma = 0.5$	(4) $\gamma = 3$
$\theta = -20$	0.0153	-0.3598	0.0726	-0.6316
$\theta = -10$	0.0153	-0.2863	0.0724	-0.5096
$\theta = -3$	0.0108	-0.0949	0.0527	-0.1760
$\theta = -1$	0.0039	-0.0113	0.0197	-0.0211
$\theta = 0$	-0.0005	0.0317	-0.0027	0.0595
$\theta = 1$	-0.0049	0.0736	-0.0247	0.1373
$\theta = 3$	-0.0113	0.1491	-0.0552	0.2734
$\theta = 10$	-0.0153	0.3062	-0.0724	0.5433
$\theta = 20$	-0.0153	0.3626	-0.0726	0.6362

Panel B: Asymmetric calibration

	$\mu_s - \mu_n$		$\sigma_s - \sigma_n$	
	(1) $\gamma = 0.5$	(2) $\gamma = 3$	(3) $\gamma = 0.5$	(4) $\gamma = 3$
$\theta = -20$	0.0224	-0.5279	0.1208	-0.6647
$\theta = -10$	0.0222	-0.4348	0.1203	-0.5252
$\theta = -3$	0.0105	-0.2000	0.0808	-0.1323
$\theta = -1$	0.0012	-0.1123	0.0390	0.0293
$\theta = 0$	-0.0025	-0.0707	0.0199	0.1058
$\theta = 1$	-0.0053	-0.0321	0.0054	0.1763
$\theta = 3$	-0.0083	0.0348	-0.0099	0.2970
$\theta = 10$	-0.0095	0.1717	-0.0167	0.5409
$\theta = 20$	-0.0096	0.2239	-0.0168	0.6328

Table 2: Simulated sectoral and aggregate quantities

This table reports the simulated returns and volatilities of sin and non-sin sector (μ_s, μ_n, σ_s, and σ_n, respectively), of the market (μ_M and σ_M), and the risk-free rate (r), all annualized and expressed in percentage terms. In Panel A, the dividend process of the two portfolios is governed by the same parameters (symmetric calibration). In Panel B, the dividend process of the two portfolios is governed by different parameters (asymmetric calibration based on Panel C of Table 3). $5,000$ trajectories of dividends are simulated, each of 50-year length. Average returns and volatilities are computed along these trajectories. $\rho = 0.05$.

Panel A: Symmetric economy

	μ_s, μ_n, μ_M, r		σ_s, σ_n, σ_M	
	(1) $\gamma = 0.5$	(2) $\gamma = 1.1$	(3) $\gamma = 0.5$	(4) $\gamma = 1.1$
$\theta = -20$	7.3, 5.8, 7.3, 4.2	8.1, 8.8, 8.1, 1.4	24.7, 17.5, 27.7	24.7, 27.3, 36.8
$\theta = -10$	7.3, 5.8, 7.3, 4.2	8.0, 8.7, 8.0, 1.4	24.7, 17.5, 27.6	24.6, 27.1, 36.5
$\theta = -3$	6.8, 5.7, 6.6, 4.2	6.6, 7.0, 6.6, 1.4	23.1, 17.8, 21.5	21.6, 23.3, 24.4
$\theta = -1$	6.1, 5.7, 5.9, 4.2	6.1, 6.2, 6.1, 1.4	20.9, 18.8, 15.1	20.6, 21.2, 15.0
$\theta = 0$	5.9, 5.9, 5.8, 4.2	6.1, 6.0, 6.0, 1.4	19.7, 19.9, 13.7	20.8, 20.7, 13.1
$\theta = 1$	5.7, 6.2, 5.9, 4.2	6.3, 6.1, 6.2, 1.4	18.7, 21.1, 14.9	21.5, 20.7, 14.4
$\theta = 3$	5.7, 6.8, 6.6, 4.2	7.1, 6.7, 6.8, 1.4	17.7, 23.2, 20.0	23.6, 21.9, 19.6
$\theta = 10$	5.8, 7.3, 7.3, 4.2	8.7, 8.1, 8.1, 1.4	17.5, 24.7, 24.7	27.2, 24.6, 24.6
$\theta = 20$	5.8, 7.3, 7.3, 4.2	8.8, 8.1, 8.1, 1.4	17.5, 24.7, 24.7	27.3, 24.7, 24.7

Panel B: Asymmetric economy

	μ_s, μ_n, μ_M, r		σ_s, σ_n, σ_M	
	(1) $\gamma = 0.5$	(2) $\gamma = 1.1$	(3) $\gamma = 0.5$	(4) $\gamma = 1.1$
$\theta = -20$	8.1, 5.8, 8.1, 3.6	8.9, 9.8, 8.9, -0.9	29.9, 17.9, 33.5	29.9, 33.0, 44.9
$\theta = -10$	8.0, 5.8, 8.0, 3.6	8.6, 9.6, 8.6, -0.9	29.9, 17.8, 33.3	29.3, 32.8, 43.5
$\theta = -3$	6.7, 6.2, 6.6, 4.0	7.5, 7.7, 7.6, 0.6	24.7, 16.7, 21.6	21.6, 23.1, 22.9
$\theta = -1$	6.5, 7.2, 6.6, 4.3	8.8, 8.6, 8.7, 1.6	21.2, 17.3, 14.1	19.7, 20.0, 13.4
$\theta = 0$	6.5, 7.8, 7.0, 4.5	9.8, 9.3, 9.5, 2.0	19.9, 17.9, 12.9	19.6, 19.2, 12.1
$\theta = 1$	6.6, 8.3, 7.6, 4.6	10.7, 10.2, 10.3, 2.3	19.0, 18.5, 13.6	19.8, 18.9, 13.1
$\theta = 3$	6.8, 8.9, 8.6, 4.7	12.3, 11.5, 11.6, 2.8	18.2, 19.2, 16.8	20.5, 18.9, 16.8
$\theta = 10$	7.0, 9.2, 9.2, 4.7	14.0, 13.0, 13.0, 3.1	17.9, 19.5, 19.5	21.7, 19.5, 19.5
$\theta = 20$	7.0, 9.2, 9.2, 4.7	14.0, 13.1, 13.1, 3.2	17.9, 19.5, 19.5	21.7, 19.5, 19.5

Table 3: Summary statistics
This table reports summary statistics for two stock portfolios. The sin portfolio includes companies involved in the production of alcoholic beverages, smoke products, and gaming (Panel A). The non-sin portfolio includes companies operating in the food, soda, fun, and meals industries (Panel B). Refer to Appendix C.1 for details on portfolio construction. The baseline sample covers U.S. companies from CRSP and Compustat between 1965 and 2015. Value-weigthed (VW) and equally-weighted (EW) portfolio excess returns are reported. *Payout yield* is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). *Dividend yield* is computed from dividend-only payments from CRSP. *Payout yield (Compustat)* is computed from dividend payments and repurchases from Compustat (Skinner, 2008). Panel C reports the summary statistics for the dividend share $d_{s,t}$ of the sin portfolio (relative to the non-sin portfolio) based both on repurchase-adjusted dividend payments and dividend-only payments. Panel D reports firm-quarter level summary statistics on institutional ownership and market capitalization for the sin and non-sin portfolios. Within the sin portfolio, two sub-portfolios based on the level of institutional ownership are created: one with high institutional ownership (i.e., in the top decile of sin stocks in the previous quarter) and one with low institutional ownership (other sin stocks). Information on institutional ownership is from the Thomson Reuters 13F database and available from 1980Q1. All the variables are at the quarterly frequency and are not annualized.

Panel A: Sin portfolio

	Mean	Std. dev.	Obs.
VW excess return	0.038	0.096	204
EW excess return	0.023	0.120	204
Payout yield	0.009	0.003	204
Div. yield	0.005	0.003	204
Payout yield (Compustat)	0.007	0.002	204
Payout yield (growth rate)	0.010	0.156	204

Panel B: Non-sin portfolio

	Mean	Std. dev.	Obs.
VW excess return	0.029	0.086	204
EW excess return	0.017	0.112	204
Payout yield	0.008	0.002	204
Div. yield	0.004	0.002	204
Payout yield (Compustat)	0.006	0.002	204
Payout yield (growth rate)	0.006	0.098	204

Panel C: Cash flow share ($d_{s,t}$)

	Mean	Std. dev.	Obs.
Payout (sin w.r.t. non-sin)	0.192	0.025	204
Dividend (sin w.r.t. non-sin)	0.187	0.035	204

Panel D: Institutional ownership

	Mean	Std. dev.	Obs.
Inst. own. (sin)	0.355	0.273	7,118
Market cap. in $B (sin)	3.122	6.440	7,118
Inst. own. (sin, high inst. own.)	0.734	0.159	645
Market cap. in $B (sin, high inst. own.)	4.971	6.441	645
Inst. own. (sin, low inst. own.)	0.317	0.252	6,473
Market cap. in $B (sin, low inst. own.)	2.938	6.412	6,473
Inst. own. (non-sin)	0.341	0.274	38,626
Market cap. in $B (non-sin)	2.549	6.165	38,626

Table 4: Analysis return and volatility spreads

This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin portfolio on the dividend share of the sin portfolio $d_{s,t}$ over the period 1965:2015. $d_{s,t}$ is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. Panel A (the baseline) considers value-weighted (VW) returns of the sin portfolio. Panel B considers equally-weighted (EW) returns. Panel C considers the extended sin portfolio. Panel D considers annual returns at annual frequency. All the variables are at the quarterly frequency, except in Panel D. Regression coefficient t-statistics are reported in parentheses. Significance tests of unconditional return and volatility spreads are reported below and include t-tests and LR tests. All t-statistics are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: VW

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.039	-0.212***	-0.458***	-0.053**	-0.136*	-0.119
	(-1.32)	(-2.83)	(-2.78)	(-2.22)	(-1.75)	(-0.74)
$d_{s,t}$	0.247	1.280***	2.953***	0.344***	0.976**	1.437*
	(1.56)	(3.12)	(3.59)	(2.73)	(2.39)	(1.84)
Mean dep. var.	0.009	0.033	0.107	0.013	0.051	0.156
t-stat	2.378	2.562	3.549	3.648	3.997	5.414
p-value	0.017	0.010	0.000	0.000	0.000	0.000
LR test (χ^2)	0.946	3.504	14.333	5.040	12.630	27.602
LR test (p-value)	0.331	0.061	0.000	0.025	0.000	0.000
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.008	0.089	0.144	0.033	0.057	0.034

Panel B: EW

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.022	-0.060	-0.144	-0.045	-0.188	-0.475*
	(-0.74)	(-0.56)	(-0.54)	(-1.51)	(-1.61)	(-1.96)
$d_{s,t}$	0.143	0.415	1.111	0.269*	1.117*	2.908**
	(0.89)	(0.74)	(0.81)	(1.74)	(1.84)	(2.46)
Mean dep. var.	0.005	0.020	0.069	0.007	0.026	0.082
t-stat	1.394	1.387	2.029	1.751	1.794	2.216
p-value	0.163	0.166	0.042	0.080	0.073	0.027
LR test (χ^2)	0.226	0.725	3.580	0.887	2.653	6.659
LR test (p-value)	0.634	0.394	0.058	0.346	0.103	0.010
Observations	204	200	192	204	201	193
$\bar{R}^2$	-0.000	0.005	0.012	0.017	0.064	0.097

(Continued)

Table 4: – *Continued*

Panel C: VW (extended)						
	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.029	-0.167**	-0.394***	-0.045*	-0.124	-0.123
	(-1.04)	(-2.48)	(-2.64)	(-1.96)	(-1.55)	(-0.83)
$d_{s,t}$	0.201	1.057***	2.636***	0.299**	0.896**	1.373*
	(1.29)	(2.79)	(3.44)	(2.43)	(2.07)	(1.77)
Mean dep. var.	0.008	0.030	0.098	0.011	0.043	0.133
t-stat	2.526	2.689	3.696	3.712	4.099	5.530
p-value	0.012	0.007	0.000	0.000	0.000	0.000
LR test (χ^2)	0.825	3.051	12.514	3.721	9.403	21.157
LR test (p-value)	0.364	0.081	0.000	0.054	0.002	0.000
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.005	0.069	0.127	0.025	0.057	0.038

Panel D: Annual frequency						
	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.146	-0.274**	-0.586***	-0.137	-0.239	-0.374
	(-0.96)	(-2.46)	(-2.94)	(-1.35)	(-1.52)	(-1.48)
$d_{s,t}$	0.947	1.611***	3.626***	0.796	1.417*	2.272*
	(1.18)	(2.78)	(3.55)	(1.53)	(1.78)	(1.80)
Mean dep. var.	0.035	0.035	0.108	0.016	0.032	0.061
t-stat	2.212	2.120	2.314	1.329	1.384	1.449
p-value	0.027	0.034	0.021	0.184	0.166	0.147
LR test (χ^2)	1.087	1.003	3.862	0.553	0.974	1.822
LR test (p-value)	0.297	0.317	0.049	0.457	0.324	0.177
Observations	51	50	48	51	50	48
$\bar{R}^2$	0.031	0.127	0.197	0.024	0.043	0.080

Table 5: Analysis of the investment strategy's risk-adjusted performance
This table reports estimates from regressions of performance measures of the baseline investment strategy (long on the sin portfolio and short on the non-sin portfolio) on the dividend share of the sin portfolio $d_{s,t}$ over the period 1965:2015. $d_{s,t}$ is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the Sharpe ratio of the investment strategy. Columns 4 through 6 analyze risk-adjusted return of the investment strategy. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. All the variables are at the quarterly frequency and the returns are value-weighted. Regression coefficient t-statistics are reported in parentheses. t-tests of significance for unconditional return and volatility spreads are reported below. All t-statistics are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

	SR_{t+k}			RAR_{t+k}		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.915	-1.338*	-2.734***	-0.020**	-0.013	-0.211***
	(-1.50)	(-1.94)	(-3.27)	(-1.99)	(-0.40)	(-2.70)
$d_{s,t}$	6.418*	8.415**	17.107***	0.117**	0.291*	1.637***
	(1.96)	(2.30)	(4.06)	(2.17)	(1.69)	(3.75)
Mean dep. var.	0.315	0.276	0.540	0.002	0.043	0.102
t-stat	3.918	2.253	3.620	1.735	9.073	6.706
p-value	0.000	0.024	0.000	0.083	0.000	0.000
Observations	204	200	192	204	200	192
$\bar{R}^2$	0.017	0.037	0.194	0.071	0.054	0.175

Table 6: Analysis of return and volatility spreads (the role of institutional investors)
This table reports estimates from regressions of return and volatility spreads between two different sin sub-portfolios (defined based on size-adjusted institutional ownership) and the non-sin portfolio on the dividend share of the relevant sin sub-portfolio over the period 1980:2015. Size-adjusted institutional ownership is the residual from a firm-quarter level panel regression of institutional ownership on firm size, as proxied by market capitalization. Within the sin portfolio, two sub-portfolios based on the level of institutional ownership are created: one with high institutional ownership (i.e., in the top decile of sin stocks in the previous quarter) and one with low institutional ownership (other sin stocks). $d_{s,t}^{HIO}$ ($d_{s,t}^{LIO}$) is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a) for the high (low) institutional ownership sin sub-portfolio. Panel A (Panel B) considers the high (low) institutional ownership sin portfolio. Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. All the variables are at the quarterly frequency and the returns are value-weighted. Regression coefficient t-statistics are reported in parentheses. Significance tests of unconditional return and volatility spreads are reported below and include t-tests and LR tests. All t-statistics are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: High institutional ownership

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	0.011	0.073	0.211*	0.080***	0.301***	0.790***
	(0.64)	(1.23)	(1.67)	(6.21)	(8.16)	(11.47)
$d_{s,t}^{HIO}$	-0.170	-2.393	-3.577	-2.228***	-8.258***	-17.960***
	(-0.20)	(-0.74)	(-0.63)	(-3.85)	(-4.94)	(-4.36)
Mean dep. var.	0.008	0.038	0.152	0.046	0.179	0.516
t-stat	0.825	1.034	1.929	5.805	7.088	9.432
p-value	0.410	0.301	0.054	0.000	0.000	0.000
LR test (χ^2)	0.533	2.098	17.596	27.726	75.633	161.181
LR test (p-value)	0.465	0.147	0.000	0.000	0.000	0.000
Observations	140	136	128	140	137	129
$\bar{R}^2$	-0.007	0.002	-0.001	0.062	0.211	0.361

Panel B: Low institutional ownership

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.041	-0.195**	-0.357*	-0.023	-0.016	0.382***
	(-1.49)	(-2.55)	(-1.81)	(-1.09)	(-0.24)	(3.60)
$d_{s,t}^{LIO}$	0.275*	1.254***	2.600***	0.227*	0.505	-0.702
	(1.79)	(3.05)	(2.73)	(1.96)	(1.40)	(-1.28)
Mean dep. var.	0.010	0.036	0.120	0.019	0.075	0.242
t-stat	1.881	1.987	2.786	4.652	5.156	8.677
p-value	0.060	0.047	0.005	0.000	0.000	0.000
LR test (χ^2)	1.117	3.057	14.215	8.548	22.840	52.968
LR test (p-value)	0.291	0.080	0.000	0.003	0.000	0.000
Observations	140	136	128	140	137	129
$\bar{R}^2$	0.011	0.083	0.109	0.014	0.016	0.014

Table 7: Micro-level sin stock holdings and payout

This table reports estimates from panel regressions of micro-level stock holdings on a sin stock indicator and its interaction with measures of payout. The sample is restricted to securities belonging either to the sin portfolio (s) or to the non-sin portfolio (n). Columns 1 to 4 focus on retail investors' holdings over the period 1991:1996. In columns 1 and 2, the dependent variable is the weight of security j in the portfolio of household h at quarter t. In columns 3 and 4, the dependent variable is overall retail ownership in percentage terms for security j at quarter t (based on LDB data). Columns 5 and 6 focus on institutional investors' holdings over the period 1980:2015. In this case, the dependent variable is overall institutional ownership in percentage terms for security j at quarter t (based on Thomson Reuters 13F data). Odd (even) columns interact the sin stock indicator variable with payout (dividend) yield from CRSP. All specifications include the security's contemporaneous excess return and quarter fixed effects. Columns 1 and 2 (3 to 6) include household-by-security (security) fixed effects. The t-statistics (in parentheses) are computed from standard errors clustered by household in columns 1 and 2, and by security in columns 3 to 4. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

	$w_{h,j,t}$		$RO\%_{j,t}$		$IO\%_{j,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Payout yield$_{j,t-1}\times$ Sin$_{j,t-1}$	-0.056*		0.116		14.418	
	(-1.68)		(0.53)		(1.41)	
Payout yield$_{j,t-1}$	0.025		0.065		1.621	
	(1.40)		(0.78)		(0.57)	
Div. yield$_{j,t-1}\times$ Sin$_{j,t-1}$		-1.842***		-1.741**		30.399
		(-4.97)		(-2.28)		(1.29)
Div. yield$_{j,t-1}$		-0.190**		0.213		-1.006
		(-2.14)		(1.63)		(-0.15)
Sin$_{j,t-1}$	0.007	0.008	0.035	0.039	5.022	5.081
	(0.32)	(0.37)	(1.32)	(1.43)	(1.48)	(1.49)
$r_{j,t} - r_{f,t}$	0.042***	0.042***	0.005	0.005	-0.908***	-0.905***
	(29.41)	(29.53)	(1.37)	(1.34)	(-3.13)	(-3.11)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Household $\times$ Security FE	Yes	Yes	No	No	No	No
Security FE	No	No	Yes	Yes	Yes	Yes
Sample	s,n	s,n	s,n	sn	s,n	s,n
& Mean dep. var.	0.257	0.257	0.067	0.067	35.092	35.092
St. dev. dep. var.	0.288	0.288	0.098	0.098	27.162	27.162
Observations	348,562	348,562	7,127	7,127	42,591	42,591
$\bar{R}^2$	0.879	0.879	0.683	0.683	0.805	0.805

Table 8: Analysis of conditional return and volatility spreads (alternative explanations)
This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin portfolio on the dividend share of the sin portfolio $d_{s,t}$, controlling for several risk factors. $d_{s,t}$ is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. All the variables are at the quarterly frequency and the returns are value-weighted. Regression specifications in Panel A include the following risk factors as control variables: the five factors proposed by Fama and French (2015), momentum, liquidity, industry concentration, and industry momentum. The five Fama-French factors comprise excess market return ($r_{m,t} - r_{f,t}$), small minus big (SMB_t), high minus low (HML_t), profitability (RMW_t) and investment (CMA_t). UMD_t denotes the momentum factor. LIQ_t denotes the Pástor and Stambaugh (2003) traded liquidity factor. $INDMOM_t$ denotes an industry momentum factor computed in the spirit of Moskowitz and Grinblatt (1999). ΔHHI_t denotes the difference in concentration between sin and non-sin industries, where concentration is measured as the Herfindahl index of total assets from Compustat. The sample period is 1968:2015, because is LIQ_t is only available from 1968. Regression specifications in Panel B control for the fraction of institutional investors that are restricted from investing in sin stocks as measured by the restricted wealth ratio (RWR_t) proposed by Luo and Balvers (2017), which is available from 1980, as well as for the factors included in Panel A. Regression specifications in Panel C control for the litigation risk differential between the sin and the non-sin portfolio (ΔLIT_t), which is available from 1996, as well as for the factors included in Panel B. The t-statistics (in parentheses) are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: Fama-French, liquidity, momentum, and industry factors

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.100***	-0.465***	-0.919***	-0.076**	-0.212	-0.385
	(-2.75)	(-4.10)	(-3.17)	(-1.98)	(-1.64)	(-1.60)
$d_{s,t}$	0.198	1.192***	2.889***	0.323**	0.875**	1.409*
	(1.22)	(2.94)	(3.58)	(2.50)	(2.27)	(1.92)
$r_{m,t} - r_{f,t}$	0.025	-0.166**	-0.188	0.109**	0.004	0.301*
	(0.41)	(-2.01)	(-1.03)	(2.14)	(0.04)	(1.69)
SML_t	-0.074	0.074	-0.123	-0.030	0.054	-0.619
	(-0.89)	(0.66)	(-0.37)	(-0.48)	(0.34)	(-1.65)
HML_t	0.124	-0.317*	-0.297	0.001	-0.473**	-0.570
	(1.09)	(-1.80)	(-0.74)	(0.01)	(-2.15)	(-1.20)
RMW_t	0.173	-0.392	-0.434	0.092	-0.041	0.215
	(1.45)	(-1.59)	(-0.89)	(1.15)	(-0.15)	(0.60)
CMA_t	0.208	0.425	0.183	0.086	0.249	0.514
	(1.46)	(1.51)	(0.33)	(0.63)	(0.86)	(0.81)
UMD_t	-0.047	-0.083	-0.066	-0.019	-0.089	-0.279
	(-0.67)	(-0.67)	(-0.37)	(-0.35)	(-0.69)	(-1.43)
LIQ_t	-0.029	0.090	0.410**	-0.071	-0.251**	-0.021
	(-0.38)	(1.05)	(1.98)	(-1.22)	(-2.33)	(-0.09)
$INDMOM_t$	0.004	0.001	0.018	-0.045	-0.029	-0.000
	(0.13)	(0.02)	(0.16)	(-1.43)	(-0.45)	(-0.00)
ΔHHI_t	0.669***	2.718***	4.679**	0.266	1.054	2.803*
	(3.12)	(3.94)	(2.23)	(0.99)	(1.19)	(1.78)
Observations	192	188	180	192	189	181
$\bar{R}^2$	0.07	0.20	0.22	0.06	0.08	0.07

(Continued)

Table 8: – *Continued*

Panel B: Restricted institutional investors						
	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.123**	-0.624***	-1.286***	-0.079	-0.156	0.074
	(-2.50)	(-4.47)	(-3.28)	(-1.61)	(-1.03)	(0.32)
$d_{s,t}$	0.284	1.646***	4.058***	0.354**	0.772*	0.144
	(1.62)	(3.97)	(4.15)	(2.41)	(1.95)	(0.21)
RWR_t	-0.007	0.271	0.702**	0.014	0.101	0.003
	(-0.12)	(1.41)	(2.07)	(0.24)	(0.52)	(0.01)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	144	140	132	144	141	133
$\bar{R}^2$	0.13	0.32	0.32	0.05	0.07	-0.02

Panel C: Litigation risk						
	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.166**	-0.903***	-1.522***	-0.143**	-0.307	-0.037
	(-2.41)	(-6.86)	(-3.65)	(-2.00)	(-1.61)	(-0.13)
$d_{s,t}$	0.101	1.728***	3.432***	0.451*	0.981**	-0.120
	(0.42)	(3.42)	(2.97)	(1.93)	(2.03)	(-0.12)
ΔLIT_t	-0.115	-0.156	-0.510	-0.044	-0.051	-0.355
	(-1.03)	(-0.51)	(-1.37)	(-0.43)	(-0.22)	(-0.88)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	76	68	80	77	69
$\bar{R}^2$	0.20	0.52	0.59	0.14	0.28	0.06

Appendix for
"Pricing Sin Stocks:
Ethical Preference vs. Risk Aversion"

A Proofs

***Proof of Proposition 1**.* We solve the problem in (5) using the martingale method of Karatzas, Lehoczky, and Shreve (1987). The optimal consumption plan is determined by the first-order conditions

$$\lambda_t = e^{-\rho t}[\alpha \pi_s^\theta D_{s,t}^{-\gamma} + (1-\alpha)\pi_n^\theta D_{n,t}^{-\gamma}], \quad e^{-\rho t}\pi_s^\theta c_{s,t}^{-\gamma} = \lambda_t p_{s,t}, \quad e^{-\rho t}\pi_n^\theta c_{n,t}^{-\gamma} = \lambda_t p_{n,t}, \quad \text{(A.1)}$$

where λ_t is the state price density (i.e., the Arrow-Debreu price of one unit of the numeraire delivered at time t in state $\omega \in \Omega$), while $p_{i,t}$ is the relative price of good $i \in \{s, n\}$. The term $\lambda_t p_{i,t}$ represents the price of one unit of good i at time t in state $\omega \in \Omega$. Prices λ_t and $p_{i,t}$ are derived by imposing the market clearing conditions on consumption. The maximization problem (5) implies

$$\left(\frac{\pi_s}{\pi_n}\right)^\theta \left(\frac{D_{s,t}}{D_{n,t}}\right)^{-\gamma} = \frac{p_{s,t}}{p_{n,t}},$$

where $\frac{\pi_s}{\pi_n} < 1$. The numeraire, which is a basket $(\alpha D_{s,t}, (1-\alpha)D_{n,t})$ with $\alpha \in [0, 1]$, has unity price, i.e.

$$\alpha p_{s,t} + (1-\alpha)p_{n,t} = 1.$$

The two equations above give the results.

□

***Proof of Proposition 2**.* The price of each risky asset is computed as the present value of the dividend stream paid by the asset, discounted using the state-price density and the relative prices determined above. Formally, we have

$$\begin{aligned} S_{s,t} &= \mathbb{E}_t \int_t^\infty \left[\frac{\lambda_u}{\lambda_t} p_{s,u} D_{s,u} du\right] = p_{s,t} D_{s,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{s,u}}{D_{s,t}}\right)^{(1-\gamma)}\right] du, \\ S_{n,t} &= \mathbb{E}_t \int_t^\infty \left[\frac{\lambda_u}{\lambda_t} p_{n,u} D_{n,u} du\right] = p_{n,t} D_{n,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{n,u}}{D_{n,t}}\right)^{(1-\gamma)}\right] du. \end{aligned} \quad \text{(A.2)}$$

Given (A.1), the expression of $S_{s,t}$ in equation (A.2) becomes

$$S_{s,t} = p_{s,t} D_{s,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{s,u}}{D_{n,t}}\right)^{(1-\gamma)}\right] du = \frac{p_{s,t} D_{s,t}}{\Gamma_s}$$

with

$$\Gamma_s = \rho + (\gamma - 1)\left(\nu_s - \frac{\phi_s^2}{2}\right) - \frac{1}{2}(1-\gamma)^2\phi_s^2.$$

$S_{n,t}$ and Γ_n are similarly derived. □

Proof of Proposition 3. We start by computing the equilibrium dynamics of stock prices. From Proposition 2 we have

$$\frac{dS_{i,t}}{S_{i,t}} = \frac{dp_{i,t}}{p_{i,t}} + \frac{dD_{i,t}}{D_{i,t}} + \frac{d[p_{i,t}D_{i,t}]}{p_{i,t}D_{i,t}}, \qquad i = s, c. \tag{A.3}$$

The equilibrium relative prices of consumption goods (6) can be rewritten as

$$\begin{aligned} p_{s,t} =& \frac{\pi_s^\theta D_{s,t}^{-\gamma}}{\alpha\pi_s^\theta D_{s,t}^{-\gamma} + (1-\alpha)\pi_n^\theta D_{n,t}^{-\gamma}} = \frac{1}{\alpha + (1-\alpha)x^\theta y_{s,t}^\gamma} \\ p_{n,t} =& \frac{x^\theta y_{s,t}^\gamma}{\alpha + (1-\alpha)x^\theta y_{s,t}^\gamma} = x^\theta y_{s,t}^\gamma p_{s,t}, \end{aligned} \tag{A.4}$$

where we have used $x := \frac{\pi_n}{\pi_s}$ and $y_{s,t} := \frac{D_{s,t}}{D_{n,t}}$. Given (1) we have

$$dy_{s,t} = y_{s,t}(\nu_s - \nu_n + \phi_n^2)dt + y_{s,t}(\phi_s dB_{s,t} - \phi_n dB_{n,t}). \tag{A.5}$$

Using the above results we can calculate $\frac{dp_{s,t}}{p_{s,t}}$:

$$dp_{s,t} = -(1-\alpha)\gamma p_{s,t}p_{n,t}\frac{dy_{s,t}}{y_{s,t}} - \frac{1}{2}(1-\alpha)\gamma p_{s,t}p_{n,t}\Big[(\gamma-1) - 2(1-\alpha)\gamma p_{n,t}\Big]\frac{(dy_{s,t})^2}{y_{s,t}^2},$$

where the second-order term is $(dy_{s,t})^2 = y_{s,t}^2(\phi_s^2 + \phi_n^2)dt$. Plugging this term and (A.5) in the expression above and rearranging, we get

$$\frac{dp_{s,t}}{p_{s,t}} = (1-\alpha)p_{n,t}\gamma[-\Lambda_t dt - \phi_s dB_{s,t} + \phi_n dB_{n,t}], \tag{A.6}$$

with

$$\Lambda_t := \nu_s - \nu_n + \phi_n^2 + \frac{1}{2}(\gamma-1)(\phi_s^2 + \phi_n^2) - (1-\alpha)\gamma p_{n,t}(\phi_s^2 + \phi_n^2).$$

Similarly for $\frac{dp_{n,t}}{p_{n,t}}$:

$$dp_{n,t} = \alpha\gamma p_{n,t}p_{s,t}\frac{dy_{s,t}}{y_{s,t}} + \frac{1}{2}\alpha\gamma p_{n,t}p_{s,t}\Big[(\gamma-1) - 2(1-\alpha)\gamma p_{n,t}\Big]\frac{(dy_{s,t})^2}{y_{s,t}^2}$$

or equivalently

$$\frac{dp_{n,t}}{p_{n,t}} = \alpha\gamma p_{s,t}[\Lambda_t dt + \phi_s dB_{s,t} - \phi_n dB_{n,t}]. \tag{A.7}$$

Hence, we have

$$\begin{aligned} \frac{d[p_{s,t}, D_{s,t}]}{p_{s,t}D_{s,t}} &= -(1-\alpha)p_{n,t}\gamma\phi_s^2 dt \\ \frac{d[p_{n,t}, D_{n,t}]}{p_{n,t}D_{n,t}} &= \alpha p_{s,t}\gamma\phi_n^2 dt. \end{aligned} \tag{A.8}$$

and therefore

$$\begin{aligned} \frac{dS_{s,t}}{S_{s,t}} =& \{\nu_s - (1-\alpha)\gamma p_{n,t}\Lambda_t - (1-\alpha)p_{n,t}\gamma\phi_s^2]\}dt + \sigma_{s,t}^s dB_{s,t} + \sigma_{n,t}^s dB_{n,t} \\ \frac{dS_{n,t}}{S_{n,t}} =& [\nu_n + \alpha\gamma p_{n,t}\Lambda_t + \alpha p_{s,t}\gamma\phi_n^2]dt + \sigma_{s,t}^c dB_{s,t} + \sigma_{n,t}^c dB_{n,t}, \end{aligned}$$

with

$$\Lambda_t := \nu_s - \nu_n + \phi_n^2 + \frac{1}{2}(\gamma-1)(\phi_s^2+\phi_n^2) - (1-\alpha)\gamma p_{n,t}(\phi_s^2+\phi_n^2),$$

and

$$\begin{aligned} \sigma_{s,t}^s &= [1-(1-\alpha)\gamma p_{n,t}]\phi_s \\ \sigma_{n,t}^s &= (1-\alpha)p_{n,t}\gamma\phi_n \\ \sigma_{s,t}^c &= \alpha\gamma p_{s,t}\phi_s \\ \sigma_{n,t}^c &= [1-\alpha\gamma p_{s,t}]\phi_n. \end{aligned}$$

Market completeness implies

$$\mu_{i,t} - r_t = \mathbb{E}_t\Big(\frac{dS_{i,t}}{S_{i,t}}\Big) + \frac{p_{i,t}D_{i,t}}{S_{i,t}} - rdt = -\mathrm{Cov}\Big(\frac{dS_{i,t}}{S_{i,t}}, \frac{d\lambda_t}{\lambda_t}\Big) \qquad i = s, c,$$

where

$$\begin{aligned} \frac{d\lambda_t}{\lambda_t} =& \Big[-\rho - \gamma\alpha p_{s,t}\nu_s - \gamma(1-\alpha)p_{n,t}\nu_n + \frac{1}{2}\gamma(\gamma+1)\Big(\alpha p_{s,t}\phi_s^2 + (1-\alpha)p_{n,t}\phi_n^2\Big)\Big]dt \\ & - \gamma\alpha p_{s,t}\phi_s dB_{s,t} - \gamma(1-\alpha)p_{n,t}\phi_n dB_{n,t}. \end{aligned}$$

$\mathrm{Cov}\Big(\frac{dS_{i,t}}{S_{i,t}}, \frac{d\lambda_t}{\lambda_t}\Big)$ follows from results above and the relation

$$\alpha p_{s,t}(1-\alpha)p_{n,t} = \alpha p_{s,t}(1-\alpha p_{s,t}) = [1-(1-\alpha)p_{n,t}](1-\alpha)p_{n,t},$$

which follows from the fact that $\alpha p_{s,t} + (1-\alpha)p_{n,t} = 1$.

Hence, we get

$$\begin{aligned} \mu_{s,t} - r_t &= (1-\alpha)^2 p_{n,t}^2 \gamma^2 \phi_n^2 + \alpha p_{s,t}\gamma\phi_s^2[1-(1-\alpha)\gamma p_{n,t}] \\ \mu_{n,t} - r_t &= \alpha^2 p_{s,t}^2\gamma^2\phi_s^2 + (1-\alpha)p_{n,t}\gamma\phi_n^2[1-\alpha\gamma p_{s,t}], \end{aligned}$$

and

$$\mu_{s,t} - \mu_{n,t} = \gamma(1-\gamma)\left[\alpha p_{s,t}\phi_s^2 - (1-\alpha)p_{n,t}\phi_n^2\right].$$

Finally, using the expression above and noting that $d_{s,t} = \frac{y_{s,t}}{1+y_{s,t}}$, we have

$$\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial d_{s,t}} = \frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial y_{s,t}}\frac{\partial y_{s,t}}{\partial d_{s,t}} = \gamma(1-\gamma)\overbrace{\left[\alpha\frac{\partial p_{s,t}}{\partial y_{s,t}}\phi_s^2 - (1-\alpha)\frac{\partial p_{n,t}}{\partial y_{s,t}}\phi_n^2\right]}^{<0}\overbrace{\frac{\partial y_{s,t}}{\partial d_{s,t}}}^{>0},$$

where the term in square brackets is negative because from Proposition 1 we have $\frac{\partial p_{s,t}}{\partial y_{s,t}} < 0$ and $\frac{\partial p_{n,t}}{\partial y_{s,t}} > 0$, while $\frac{\partial y_{s,t}}{\partial d_{s,t}} = \frac{1}{(1-d_{s,t})^2} > 0$ immediately follows from the definition of $d_{s,t}$. Hence, we conclude that

$$\frac{\partial(\mu_{s,t}-\mu_{n,t})}{\partial d_{s,t}} = \gamma(1-\gamma)\overbrace{[...]}^{<0}$$

is positive when $\gamma > 1$ and negative otherwise. □

Proof of Proposition 4. The instantaneous standard deviations of the two assets are

$$\sigma_{s,t} = \sqrt{\left(\sigma_{s,t}^s\right)^2 + \left(\sigma_{n,t}^s\right)^2} \qquad \text{and} \qquad \sigma_{n,t} = \sqrt{\left(\sigma_{s,t}^n\right)^2 + \left(\sigma_{n,t}^n\right)^2},$$

where $\sigma_{j,t}^i$, with $i, j \in \{s, n\}$, are defined above. The volatility spread between sin and non-sin stocks is therefore

$$\sigma_{s,t} - \sigma_{n,t} = \sqrt{[1-(1-\alpha p_{s,t})\gamma)]^2\phi_s^2 + [(1-\alpha p_{s,t})\gamma\phi_n]^2} - \sqrt{(\alpha\gamma p_{s,t}\phi_s)^2 + [(1-\alpha\gamma p_{s,t})\phi_n]^2}.$$

We have

$$\frac{\partial(\sigma_{s,t}-\sigma_{n,t})}{\partial d_{s,t}} = \overbrace{\frac{x^\theta y_{s,t}^{\gamma-1}\alpha p_{s,t}^2\gamma^2(1-\alpha)}{(\phi_s^2+\phi_n^2)\sigma_{n,t}\sigma_{s,t}}\frac{\partial y_{s,t}}{\partial d_{s,t}}}^{>0}\overbrace{[(1-\alpha p_{s,t})\sigma_{n,t} + \alpha p_{s,t}\sigma_{s,t}]}^{>0}(\gamma - F(\gamma)),$$

where

$$F(\gamma) := \frac{(1-q)\,\sigma_{n,t} + q\sigma_{s,t}}{(1-\alpha p_{s,t})\sigma_{n,t} + \alpha p_{s,t}\sigma_{s,t}}, \qquad \text{with } q := \frac{\phi_n^2}{\phi_s^2+\phi_n^2}.$$

It is sufficient to study the sign of $\gamma - F(\gamma)$. We consider two cases separately: $\gamma > 1$ and $\gamma \in (0, 1)$.

Case 1. Assume $\gamma > 1$. We show that $\gamma > F(\gamma)$. Suppose that $\exists \gamma > 1$ such that $\gamma \leq F(\gamma)$, we show that this leads to a contradiction. From $\gamma \leq F(\gamma)$, we get

$$\gamma - 1 + (\gamma\alpha p_{s,t} - q)(z_{s,t} - 1) \leq 0, \tag{A.9}$$

with $z_{s,t} := \sigma_{s,t}/\sigma_{n,t} > 0$. Here three cases can occur.

First, assume $\gamma\alpha p_{s,t} - q > 0$. We have

$$z_{s,t} \leq 1 - \frac{\gamma - 1}{\gamma\alpha p_{s,t} - q}.$$

Since $z_{s,t} > 0$, we must have $1 - \frac{\gamma-1}{\gamma\alpha p_{s,t}-q} \in (0, 1)$, that is $\gamma(1 - \alpha p_{s,t}) < 1 - q$. Notice also that

$$\gamma(1 - \alpha p_{s,t}) < 1 - q \quad \Leftrightarrow \quad \gamma\alpha p_{s,t} - q > \gamma - 1. \tag{A.10}$$

Assuming (A.10), $z_{s,t} \leq 1 - \dfrac{\gamma - 1}{\gamma\alpha p_{s,t} - q}$ holds iff $z_{s,t}^2 \leq \left(1 - \dfrac{\gamma - 1}{\gamma\alpha p_{s,t} - q}\right)^2$, that is

$$\begin{aligned}
&\overbrace{(\gamma - 1)}^{>0}\overbrace{(\gamma - 1 + 2q - 2\alpha p_{s,t}\gamma)}^{<0}(\gamma\alpha p_{s,t} - q)^2 \\
&\leq \overbrace{(\gamma - 1)}^{>0}\overbrace{(\gamma - 1 + 2q - 2\gamma\alpha p_{s,t})}^{<0}[(\alpha\gamma p_{s,t})^2 + (1 - 2\alpha\gamma p_{s,t})q].
\end{aligned}$$

Therefore, we have

$$(\gamma\alpha p_{s,t} - q)^2 \geq (\alpha\gamma p_{s,t} - q)^2 + q(1 - q),$$

which never holds if $\phi_s, \phi_n > 0$.

Second, assume $\gamma\alpha p_{s,t} - q < 0$. Equation (A.9) becomes

$$\gamma - 1 - (q - \gamma\alpha p_{s,t})(z_{s,t} - 1) \leq 0 \tag{A.11}$$

or equivalently

$$z_{s,t} \geq 1 + \frac{\gamma - 1}{q - \gamma\alpha p_{s,t}}.$$

This inequality hold iff

$$z_{s,t}^2 \geq \left(1 + \frac{\gamma - 1}{q - \gamma\alpha p_{s,t}}\right)^2,$$

that is

$$\begin{aligned}&\overbrace{(\gamma-1)}^{>0}\overbrace{(\gamma-1+2q-2\alpha p_{s,t}\gamma)}^{>0}(\gamma\alpha p_{s,t}-q)^2\\ &\geq\overbrace{(\gamma-1)}^{>0}\overbrace{(\gamma-1+2q-2\gamma\alpha p_{s,t})}^{>0}[(\alpha\gamma p_{s,t})^2+(1-2\alpha\gamma p_{s,t})q],\end{aligned}$$

where now $\gamma-1+2q-2\alpha p_{s,t}\gamma>0$. Therefore we obtain again

$$(\gamma\alpha p_{s,t}-q)^2\geq(\alpha\gamma p_{s,t}-q)^2+q(1-q)$$

and this expression never holds if $\phi_s,\phi_n>0$.

Third, assume $\gamma\alpha p_{s,t}-q=0$. In this case it is immediate that (A.9) never holds.

Hence, if $\gamma>1$ we have $\gamma>F(\gamma)$ and

$$\frac{\partial}{\partial d_{s,t}}(\sigma_{s,t}-\sigma_{n,t})>0.$$

Case 2. Assume $\gamma\in(0,1)$. We show that $\gamma<F(\gamma)$. Suppose that $\exists\gamma\in(0,1)$ such that $\gamma\geq F(\gamma)$, we show that this leads to a contradiction. From $\gamma\geq F(\gamma)$, we get

$$(\gamma\alpha p_{s,t}-q)(z_{s,t}-1)-(1-\gamma)\geq 0. \tag{A.12}$$

Here three cases can occur.

First, assume $\gamma\alpha p_{s,t}-q>0$. We have

$$z_{s,t}\geq 1+\frac{1-\gamma}{\gamma\alpha p_{s,t}-q}\ \Leftrightarrow\ z_{s,t}^2\geq\left(1+\frac{1-\gamma}{\gamma\alpha p_{s,t}-q}\right)^2,$$

that is

$$\begin{aligned}&\overbrace{(\gamma-1)}^{<0}\overbrace{(\gamma-1+2q-2\alpha p_{s,t}\gamma)}^{<0}(\gamma\alpha p_{s,t}-q)^2\\ &\geq\overbrace{(\gamma-1)}^{<0}\overbrace{(\gamma-1+2q-2\gamma\alpha p_{s,t})}^{<0}[(\alpha\gamma p_{s,t})^2+(1-2\alpha\gamma p_{s,t})q].\end{aligned}$$

Therefore, we obtain

$$(\gamma\alpha p_{s,t}-q)^2\geq(\alpha\gamma p_{s,t}-q)^2+q(1-q),$$

and this expression never holds if $\phi_s,\phi_n>0$.

Second, assume $\gamma\alpha p_{s,t}-q<0$. Equation (A.12) becomes

$$(q-\gamma\alpha p_{s,t})(z_{s,t}-1)+(1-\gamma)\leq 0$$

or

$$z_{s,t} \leq 1 - \frac{1-\gamma}{q - \gamma\alpha p_{s,t}}.$$

Since $z_{s,t} > 0$, this inequality holds only if

$$1 - \gamma < q - \gamma\alpha p_{s,t}. \tag{A.13}$$

Assuming (A.13)

$$z_{s,t} \leq 1 - \frac{1-\gamma}{q - \gamma\alpha p_{s,t}} \quad \Leftrightarrow \quad z_{s,t}^2 \leq \left(1 - \frac{1-\gamma}{q - \gamma\alpha p_{s,t}}\right)^2,$$

that is

$$\begin{aligned}
&\overbrace{(\gamma - 1)}^{<0}\overbrace{(\gamma - 1 + 2q - 2\alpha p_{s,t}\gamma)}^{>0}(\gamma\alpha p_{s,t} - q)^2 \\
&\leq \overbrace{(\gamma - 1)}^{<0}\overbrace{(\gamma - 1 + 2q - 2\gamma\alpha p_{s,t})}^{>0}[(\alpha\gamma p_{s,t})^2 + (1 - 2\alpha\gamma p_{s,t})q].
\end{aligned}$$

Therefore, we have

$$(\gamma\alpha p_{s,t} - q)^2 \geq (\alpha\gamma p_{s,t} - q)^2 + q(1-q),$$

which never holds if $\phi_s, \phi_n > 0$.

Third, assume $\gamma\alpha p_{s,t} - q = 0$. In this case it is immediate that (A.12) never holds.

Hence, if $\gamma \in (0, 1)$, then we have $\gamma < F(\gamma)$ and

$$\frac{\partial}{\partial d_{s,t}}(\sigma_{s,t} - \sigma_{n,t}) < 0.$$

□

B Alternative calibration

In Figure B.1 (high risk aversion case: $\gamma = 3$) and Figure B.2 (low risk aversion case: $\gamma = 0.5$), we report the results from an alternative calibration exercise, where we account for different fundamentals across the two firms in our model. In this case, we set the payout parameters to their empirically observed values, that is, $\nu_s = 4 \times 0.010$, $\nu_n = 4 \times 0.006$, $\phi_s = \sqrt{4} \times 0.156$, and $\phi_n = \sqrt{4} \times 0.098$. In addition, we set $\alpha = 0.192$, consistent with the observed average share of the total payout of sin companies (Panel C of Table 3).

C Data

C.1 Portfolio construction

We follow Hong and Kacperczyk (2009) and define sin companies as those operating in the following industries.

- Alcoholic beverages (Fama-French industry 4): SIC codes 2080-2085.[30]
- Smoke products (Fama-French industry 5): SIC codes 2100-2199.
- Gaming: NAICS codes 7132, 71321, 713210, 71329, 713290, 72112, and 721120.

For the extended sin portfolio, we include also companies active in the following industries.

- Distribution of alcoholic beverages: SIC codes 5180-5189, 5813, and 5921.
- Distribution of smoke products: SIC codes 5194 and 5993.

Non-sin (comparable) companies are those operating in the following industries.

- Food (Fama-French industry 2): SIC codes 2000-2009, 2010-2019, 2020-2029, 2030-2039, 2040-2046, 2050-2059, 2060-2063, 2070-2079, 2090-2092, 2095, and 2098-2099.
- Soda (Fama-French industry 3): SIC codes 2064-2068, 2086, 2087, 2096, and 2097.
- Fun (Fama-French industry 7): SIC codes 7800-7829, 7830-7833, 7840-7841, 7900, 7910-7911, 7920-7929, 7930-7933, 7940-7949, 7980, and 7990-7999.
- Meals (Fama-French industry 43, excluding drinking places): SIC codes 5800-5812, 5814-5819, 5820-5829, 5890-5899, 7000, 7010-7019, 7040-7049, and 7213-7213.

We identify companies operating in the industries above using both firm-level industry codes from CRSP, and primary and secondary segment-level industry codes from Compustat Segment files. Because Compustat Segment files are available only starting in 1976, we backfill segment industry codes over the pre-1976 period, in line with Hong and Kacperczyk (2009).

We manually checked the sin stocks obtained through this procedure and removed those that are not involved in sinful activities. This is the case of firms that are assigned the general SIC code for beverages 2080 but do not actually produce alcoholic beverages (e.g., the Coca-Cola Bottling Company). Moreover, firms that operate both in the sin industries and non-sin industries above are classified as sinful.

Finally, we checked our list of sin companies against the list made available by Hong and Kacperczyk (2009) for the period 1962-2003. Our algorithm is able to capture 178 out of the 184 companies included in their list. We manually added the remaining six companies to our sin portfolio.[31]

[30] Fama-French industry groups refer to the 48-industry classification by Fama and French (1997).

[31] In the baseline analysis, we rely on historical CRSP and NAICS codes from CRSP to identify relevant stocks. However, CRSP information on NAICS is available only from 2004. Before 2004, we thus identify gaming stocks only through Compustat Segment NAICS information. To a large extent, we add back those gaming stocks that we miss by supplementing our sin stock list with that by Hong and Kacperczyk (2009) at http://www.columbia.edu/~hh2679/sinstocks.pdf. Yet, in Panel C of Table C.4, we show that the main results are robust to identifying gaming stocks using the main Compustat NAICS code, which is also available before 2004 but has the disadvantage that it is not historical.

C.2 International evidence

In this section, we extend the baseline analysis to an international sample to study whether potential cross-country heterogeneity in social norms alters the pricing of sin stocks as well as the relation between dividend payments and ethicalness. Using Worldscope Stock Data, we obtain information on a sample of stocks from G20 countries (U.S. excluded) as well as the Netherlands, Spain, and Switzerland for the period 1980Q1-2015Q4. For this sample, we are not able to implement a precise adjustment of payouts for repurchases, so $d_{s,t}$ is based on dividends only.[32]

In Table C.1, we carry out unconditional and conditional tests over the international sample. Except for the unconditional tests on the volatility spread – generally negative but indistinguishable from zero – all the results line up well with those for the U.S. All in all, these results point to no stark differences in investors' attitude towards sin stocks between the U.S. and our international sample. However, it is worth noting that countries with social norms similar to the U.S. – such as Canada, France, Italy, and the UK Fauver and McDonald (2014); Hong and Kacperczyk (2009) – account for a large fraction of the international portfolio's market capitalization, which may mask some of the existing heterogeneity, especially in smaller economies.

C.3 Cyclicality of sin good consumption

As argued above, stocks of sin companies may have low exposure to aggregate risk because of the addictive nature of the goods they produce. To support this conjecture, here we analyze the cyclical properties of sin good consumption. Using data from FRED, we look at the correlation between the growth of sin good consumption and two business cycle variables, namely GDP (GDPC1) growth and aggregate consumption (PCECA) growth.

Data on personal consumption of sin goods are available at annual frequency. Sin good consumption is obtained by summing up the following components:

- Alcoholic beverages (DAOPRC1A027NBEA);
- Tobacco (DTOBRC1A027NBEA);
- Gambling (DGAMRC1A027NBEA).

We contrast the cyclical properties of sin goods against those of non-sin goods, where consumption of the latter is obtained by summing up the following components:

- Recreation services (DRCARC1A027NBEA);
- Food services and accommodation away from home (DFSARC1A027NBEA);
- Food and nonalcoholic beverages at home (DTFDRC1A027NBEA).

[32] Rather than applying a country-specific inflation adjustment – which may pose issues of data availability for some of the countries –, we filter out nominal effects by looking at return and volatility spreads. This is not necessarily an innocuous simplification, because it amounts to assuming homogeneous inflation (or homogeneous country composition of the sin and non-sin portfolio) across the included countries, among which some experienced high inflation episodes over the sample period.

Given that durability correlates positively with cyclicality of a given good consumption (Gomes, Kogan, and Yogo, 2009), we also compare sin goods vis-à-vis durable goods (PCDGA). All the series above are available throughout the sample period (1965-2015) and expressed in real terms. We conduct the analysis at the annual frequency.

Table C.2 reports the coefficient estimates of regressions of consumption growth of different goods on GDP growth (Panel A) and aggregate consumption growth (Panel B). We observe that sin good consumption, while positively correlated with business cycle variables, is significantly less cyclical than durable good consumption. Sin goods also appear to be less cyclical than non-sin goods in both Panel A and Panel B, but the difference is statistically significant only when using aggregate consumption as explanatory variable, which is not surprising since our non-sin goods are nondurable goods.

C.4 Other tests

Table C.3 re-estimates equations (13) and (14) using alternative dividend measures to compute the dividend share $d_{s,t}$. Panel A uses dividends alone, i.e., without repurchases (Bansal et al., 2005a). Again, we find a positive and statistically significant association between both the return and volatility spread, and $d_{s,t}$. Panel B uses payouts from Compustat as defined by Skinner (2008). In this case, we find a positive and statistically significant association between the volatility spread and $d_{s,t}$ at all horizons. By contrast, for the return spread, the estimated $d_{s,t}$ coefficient is positive but insignificant.

It is worth noting that our empirical measure of dividend share ($d_{s,t} = \frac{D_{s,t}}{D_{s,t}+D_{n,t}}$) is expressed in units of consumption of the CPI basket. Using the model notation, this measure can be seen as dividends in terms of numeraire units, namely $p_{i,t}D_{i,t}$ for $i \in \{s, n\}$. Therefore, we also construct the time series of relative prices $p_{s,t}$ and $p_{n,t}$, and convert each portfolio's payouts into the corresponding consumption streams ($D_{s,t}$, $D_{n,t}$). To this end, in the spirit of Ferson and Constantinides (1991), we use seasonally adjusted series on CPI components from FRED to compute the relative prices p_s and p_n of sin and non-sin goods.[33] While the dividend share measure obtained in this way is the closest to the model, it is available only starting in 1986Q1 and arguably noisy. Because of this, with a slight abuse of notation, we denote it as $\tilde{d}_{s,t}$ rather than $d_{s,t}$. In Panel C of Table C.3, we repeat our tests using $\tilde{d}_{s,t}$ as the explanatory variable. The relation between the volatility spread and $\tilde{d}_{s,t}$ is positive and significant. The relation is positive but insignificant for the return spread.

Finally, Table C.4 reports further robustness tests for the unconditional and conditional analysis:

- Using the extended sample period 1926Q3:2015Q4 (Panel A);

[33]The sin goods price index is computed as the average of the prices of alcoholic beverages (CUSR0000SAF116, available from 1967Q1), and tobacco and smoking products (CUSR0000SEGA, available from 1986Q1); the time series of prices of gaming products and services is not available. The non-sin goods price index is computed as the average of the prices of recreation (CPIRECSL, available from 1993Q1), food at home (CUSR0000SAF11, available from 1952Q1), food away from home (CUSR0000SEFV, available from 1953Q1), lodging away from home (CUSR0000SEHB, available from 1998Q1).

- Using an alternative measure of volatility based on squared deviations from the unconditional mean return $\tilde{\sigma}_t$ (Panel B);
- Identifying gaming stocks by means of the NAICS codes provided by Compustat rather than CRSP (Panel C).

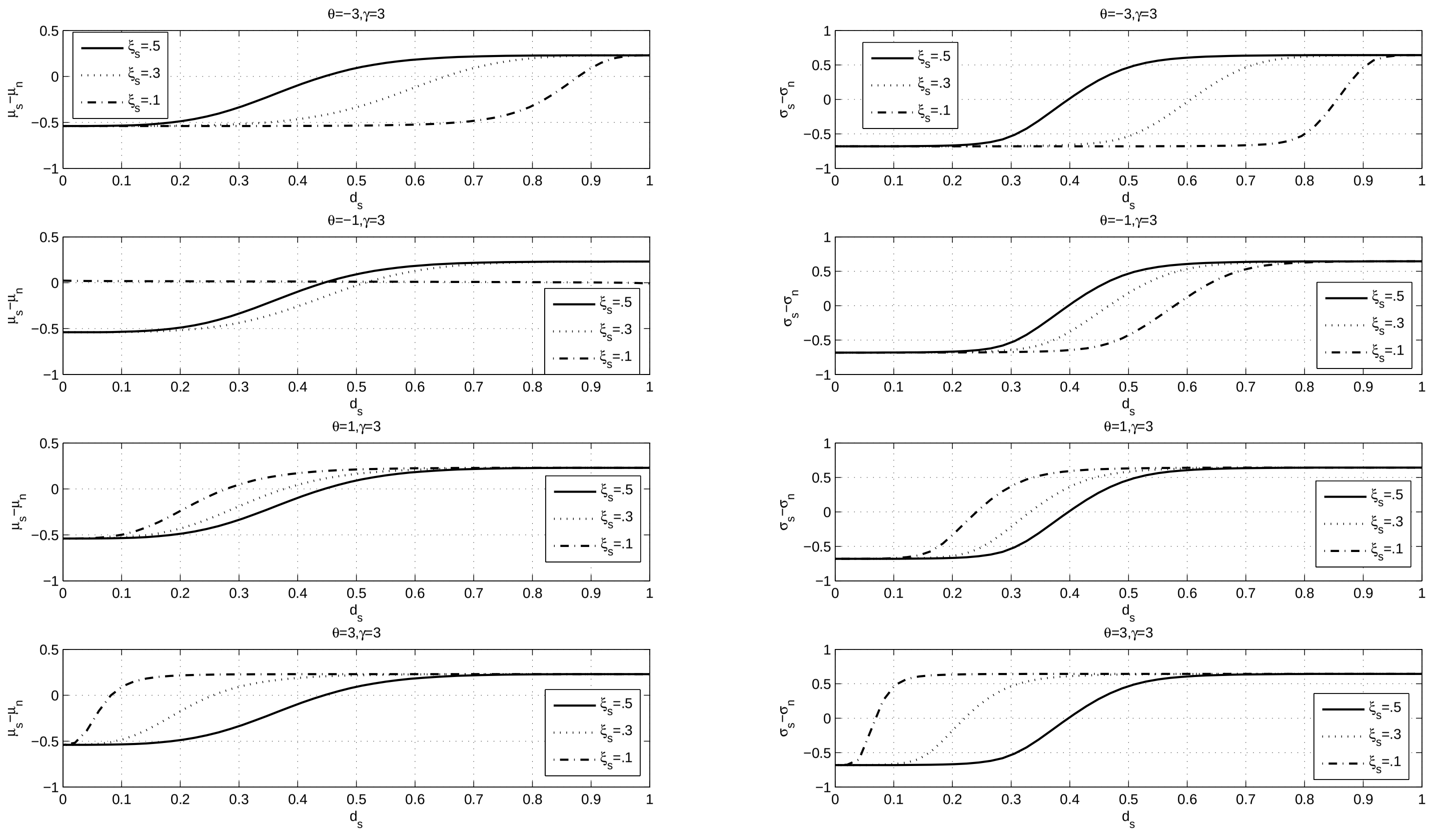

Figure B.1: Conditional return and volatility spread between sin and non-sin stocks with high risk aversion (asymmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the non-sin stock as a function of the dividend share $d_{s,t}$ in the case of high risk aversion ($\gamma = 3$).

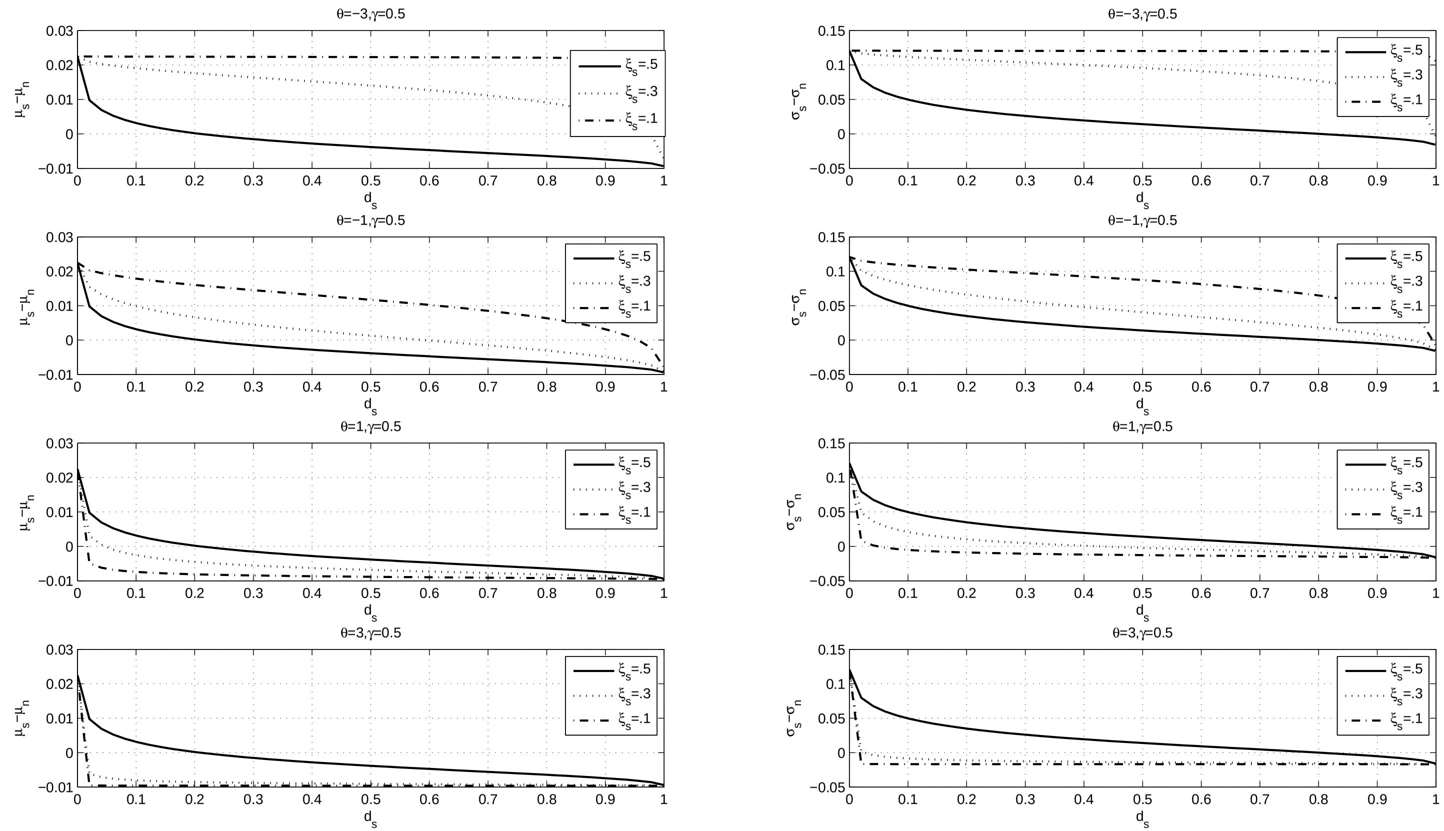

Figure B.2: Conditional return and volatility spread between sin and non-sin stocks with low risk aversion (asymmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the non-sin stock as a function of the dividend share $d_{s,t}$ in the case of low risk aversion ($\gamma = 0.5$).

Table C.1: Analysis of return and volatility spreads (international evidence)
This table reports estimates from regressions of international return and volatility spreads between the sin and the non-sin portfolio on the dividend share of the sin portfolio $d_{s,t}$ over the period 1980:2015. $d_{s,t}$ is computed from dividend payments as reported in Worldscope. The international sample comprises stocks from G20 countries (US excluded) as well as the Netherlands, Spain, and Switzerland. Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. All the variables are at the quarterly frequency and the returns are value-weighted. Regression coefficient t-statistics are reported in parentheses. Significance tests of unconditional return and volatility spreads are reported below and include t-tests and LR tests. All t-statistics are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.006	-0.071	-0.053	-0.027**	-0.120***	-0.276***
	(-0.41)	(-1.35)	(-0.40)	(-2.41)	(-3.48)	(-3.68)
$d_{s,t}$	0.048	0.333**	0.511	0.080**	0.354***	0.800***
	(1.19)	(2.38)	(1.44)	(2.49)	(3.70)	(3.73)
Mean dep. var.	0.009	0.037	0.121	-0.001	-0.003	-0.007
t-stat	2.284	2.645	4.120	-0.355	-0.318	-0.301
p-value	0.022	0.008	0.000	0.723	0.751	0.763
LR test (χ^2)	1.368	5.302	18.041	0.048	0.103	0.137
LR test (p-value)	0.242	0.021	0.000	0.826	0.748	0.711
Observations	141	137	129	141	138	130
$\bar{R}^2$	0.000	0.070	0.048	0.026	0.147	0.203

Table C.2: Cyclicality of sin good consumption
This table reports estimates from regressions of real consumption growth of different goods on measures of the business cycle. Panel A uses real GDP growth as explanatory variable. Panel B uses real aggregate consumption growth as explanatory variable. The two panels follow the same structure. Column 1 analyzes the growth of real consumption of sin goods. Column 2 analyzes the growth of real consumption of non-sin goods. Column 3 analyzes the growth of real consumption of durable goods. All the variables are at the annual frequency and the sample period is from 1965 to 2015. The last row reports the Chi-square p-value for the Wald test of differences in the coefficient of the explanatory variable. This test is performed with respect to sin goods. The t-statistics (in parentheses) are computed using Huber-White standard errors. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.3 for details on variable construction.

Panel A: Correlation with GDP growth			
	Δ% Consumption		
	(1) Sin goods	(2) Non-sin goods	(3) Durable goods
Constant	0.005	-0.001	-0.009
	(1.13)	(-0.18)	(-1.15)
Δ% GDP	0.543***	0.728***	0.846***
	(4.19)	(4.67)	(4.32)
Observations	51	51	51
$\bar{R}^2$	0.25	0.36	0.34
H_0: Diff. w.r.t. sin goods =0 (p-value)		0.15	0.04

Panel B: Correlation with aggregate consumption growth			
	Δ% Consumption		
	(1) Sin goods	(2) Non-sin goods	(3) Durable goods
Constant	0.002	-0.005**	-0.013***
	(0.79)	(-2.16)	(-4.30)
Δ% Aggregate consumption	0.697***	0.929***	1.079***
	(7.24)	(17.84)	(14.08)
Observations	51	51	51
$\bar{R}^2$	0.54	0.76	0.70
H_0: Diff. w.r.t. sin goods =0 (p-value)		0.02	0.00

Table C.3: Analysis of conditional return and volatility spreads (alternative dividend share measures) This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin portfolio on alternative measures of the dividend share of the sin portfolio $d_{s,t}$. Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Columns 1 and 4 show results at the one-year investment horizon. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. All the variables are at the quarterly frequency and the returns are value-weighted. In Panel A (sample period 1965:2015), $d_{s,t}$ is computed from dividend-only payments from CRSP. In Panel B (sample period 1965:2015), $d_{s,t}$ is computed from dividend payments and repurchases from Compustat (Skinner, 2008). Panel C uses the quantity-based dividend share $\tilde{d}_{s,t}$, which is adjusted for the relative price of sin and non-sin goods and is available from 1986 (see Appendix C.4). The t-statistics (in parentheses) is computed computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: Dividends only

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	k =0Y	k =1Y	k =3Y	k =0Y	k =1Y	k =3Y
Constant	-0.041**	-0.108*	-0.293**	-0.008	-0.018	-0.128
	(-2.46)	(-1.84)	(-2.26)	(-0.59)	(-0.36)	(-1.10)
$d_{s,t}$	0.266***	0.757**	2.158***	0.111	0.370	1.531***
	(2.90)	(2.36)	(3.20)	(1.63)	(1.50)	(2.69)
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.023	0.056	0.143	0.003	0.011	0.077

Panel B: Compustat

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	k =0Y	k =1Y	k =3Y	k =0Y	k =1Y	k =3Y
Constant	-0.065*	-0.136	-0.163	-0.090***	-0.316***	-0.277
	(-1.88)	(-1.39)	(-0.82)	(-3.65)	(-4.26)	(-1.59)
$d_{s,t}$	0.390**	0.889	1.424	0.541***	1.927***	2.283***
	(2.10)	(1.65)	(1.33)	(4.17)	(4.90)	(2.66)
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.023	0.033	0.024	0.075	0.200	0.078

Panel C: Quantity-based

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	k =0Y	k =1Y	k =3Y	k =0Y	k =1Y	k =3Y
Constant	-0.004	-0.026	0.068	-0.020	-0.051	0.046
	(-0.22)	(-0.40)	(0.47)	(-1.56)	(-1.11)	(0.42)
$\tilde{d}_{s,t}$	0.054	0.229	0.206	0.143***	0.462***	0.721**
	(0.83)	(1.02)	(0.43)	(3.19)	(2.83)	(2.01)
Observations	120	116	108	120	117	109
$\bar{R}^2$	-0.01	0.00	-0.01	0.03	0.09	0.08

Table C.4: Analysis of return and volatility spreads (other tests)
This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin portfolio on the dividend share of the sin portfolio $d_{s,t}$. $d_{s,t}$ is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Contemporaneous specifications are reported in columns 1 and 4. Predictive specifications at the one- and three-year horizon are reported in columns 2-3 and 5-6. Panel A considers the extended sample period 1926Q3:2015Q4. Panel B uses an alternative measure of volatility based on squared deviations from the unconditional mean return. Panel C uses an alternative classification of gaming stocks based on NAICS codes from Compustat rather than CRSP. Except in Panel A, the sample period is 1965:2015. All the variables are at the quarterly frequency and the returns are value-weighted. Regression coefficient t-statistics are reported in parentheses. Significance tests of unconditional return and volatility spreads are reported below and include t-tests and LR tests. All t-statistics are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels is indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: 1926Q3:2015Q4

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.008	-0.048	-0.094	-0.015	-0.039	-0.076
	(-0.49)	(-0.82)	(-0.77)	(-1.42)	(-1.02)	(-0.90)
$d_{s,t}$	0.070	0.385	0.924	0.158**	0.496**	1.241***
	(0.75)	(1.15)	(1.30)	(2.57)	(2.26)	(2.63)
Mean dep. var.	0.004	0.012	0.047	0.010	0.041	0.120
t-stat	1.051	0.985	1.822	3.563	3.864	4.956
p-value	0.293	0.324	0.068	0.000	0.000	0.000
LR test (χ^2)	0.249	0.671	4.194	3.901	9.625	17.836
LR test (p-value)	0.618	0.413	0.041	0.048	0.002	0.000
Observations	355	351	343	355	352	344
$\bar{R}^2$	0.000	0.016	0.035	0.017	0.045	0.074

Panel B: Alternative volatility measure

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\tilde{\sigma}_{s,t+k} - \tilde{\sigma}_{n,t+k}$		
	(1) k =0Y	(2) k =1Y	(3) k =3Y	(4) k =0Y	(5) k =1Y	(6) k =3Y
Constant	-0.039	-0.212***	-0.458***	-0.053**	-0.098**	-0.134**
	(-1.32)	(-2.83)	(-2.78)	(-2.22)	(-2.22)	(-2.39)
$d_{s,t}$	0.247	1.280***	2.953***	0.344***	0.640***	0.898***
	(1.56)	(3.12)	(3.59)	(2.73)	(2.74)	(3.28)
Mean dep. var.	0.009	0.033	0.107	0.013	0.025	0.038
t-stat	2.378	2.562	3.549	3.648	3.568	4.005
p-value	0.017	0.010	0.000	0.000	0.000	0.000
LR test (χ^2)	0.946	3.504	14.333	1.590	4.094	8.723
LR test (p-value)	0.331	0.061	0.000	0.207	0.043	0.003
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.008	0.089	0.144	0.033	0.084	0.136

(Continued)

Table C.4: – *Continued*

Panel C: Alternative classification of gaming stocks

	$\mu_{s,t+k} - \mu_{n,t+k}$			$\sigma_{s,t+k} - \sigma_{n,t+k}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	k =0Y	k =1Y	k =3Y	k =0Y	k =1Y	k =3Y
Constant	-0.040	-0.214***	-0.460***	-0.053**	-0.137*	-0.128
	(-1.37)	(-2.84)	(-2.77)	(-2.24)	(-1.77)	(-0.82)
$d_{s,t}$	0.257	1.291***	2.965***	0.345***	0.978**	1.490*
	(1.61)	(3.13)	(3.59)	(2.75)	(2.42)	(1.96)
Mean dep. var.	0.009	0.034	0.109	0.013	0.051	0.158
t-stat	2.427	2.612	3.616	3.755	4.115	5.604
p-value	0.015	0.009	0.000	0.000	0.000	0.000
LR test (χ^2)	0.989	3.668	14.948	5.172	12.966	28.522
LR test (p-value)	0.320	0.055	0.000	0.023	0.000	0.000
Observations	204	200	192	204	201	193
$\bar{R}^2$	0.009	0.091	0.145	0.034	0.059	0.039